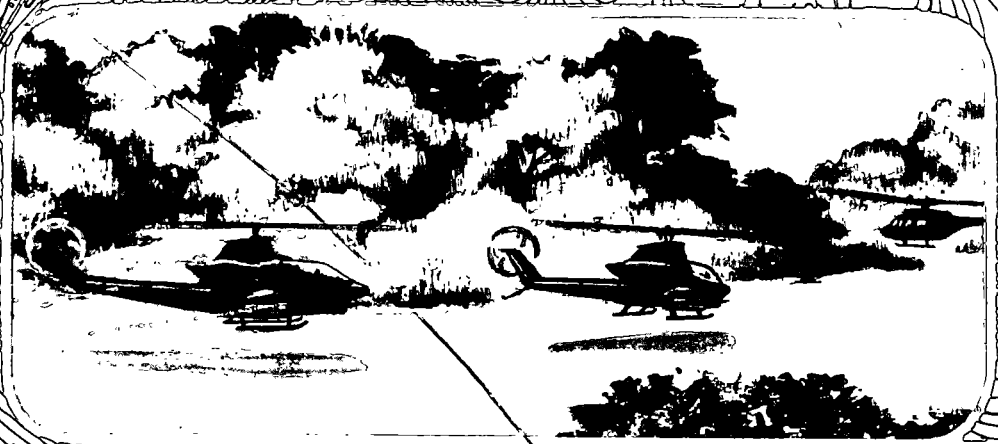

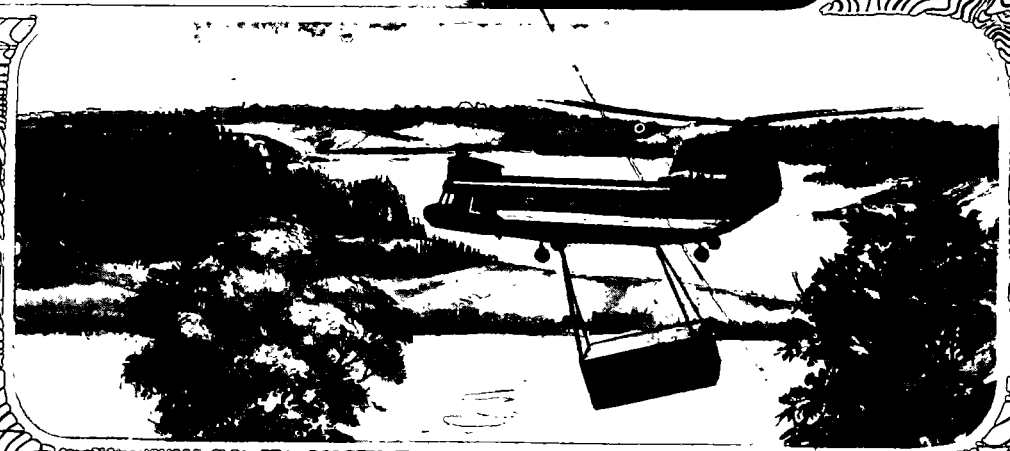

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FM 1-1

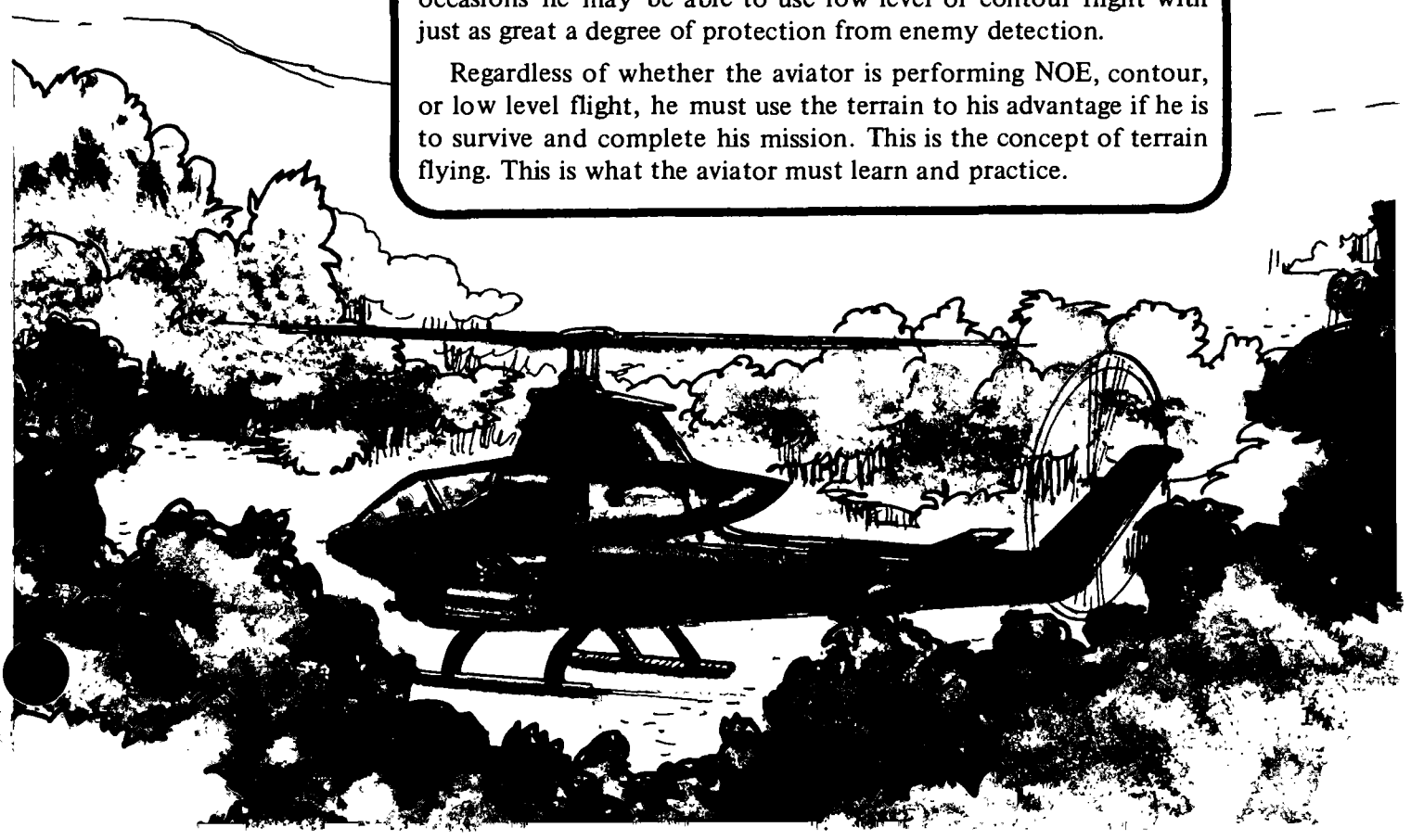
TERRAIN FLYING

Preface

This manual was originally published as TC 1-15, Nap-of-the-Earth Flight Training. However, nap-of-the-earth was not truly descriptive of the flight profiles required for the High Threat Environment. Rather, terrain flight is a broader and more meaningful term relating to battlefield survivability. While it generally is true that reasonable altitude is desired for flight safety considerations, for operational considerations, flight at altitude may well be lethal. Thus, pure flight safety cannot be paramount in the determination of tactics but must support operational capabilities and mission accomplishment.

Where the terrain permits within the context of the enemy, the aviator will employ such altitude and airspeed as best enhances safety and his mission. However, enemy detection and engagement capabilities may dictate combinations of low level, contour, and nap-of-the-earth flight as well as hover, pop-up, sideslip, dash, quick stop, and land. In the face of the high threat enemy, the aviator must keep in mind that what can be seen can be hit. Therefore, he must use the terrain to provide protection from detection and engagement by the enemy and to use the terrain so that he, not his enemy, has the tactical advantage. In other words, he exposes himself only when he is ready. In order to accomplish this, he will often have no choice but to use NOE. On other occasions he may be able to use low level or contour flight with just as great a degree of protection from enemy detection.

Regardless of whether the aviator is performing NOE, contour, or low level flight, he must use the terrain to his advantage if he is to survive and complete his mission. This is the concept of terrain flying. This is what the aviator must learn and practice.



Terrain Flying

*FM 1-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C. *1 October 1975*

Users of this manual are encouraged to submit recommended changes and comments to improve the publication. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to the *Commander, US Army Aviation Center, ATTN: ATZQ-D-TL, Fort Rucker, Alabama 36360.*

*This manual supersedes TC 1-15, 29 June 1973.

Purpose and Scope

The primary purpose of this publication is to provide guidance to assist the commander in establishing training programs which progress from individual NOE qualification through advanced unit training. With this in mind, this manual discusses the training required to prepare the individual aviator and the aviation tactical unit to operate using terrain flight as an aid to survivability and mission success. The training described includes initial individual qualification, advanced unit tactical training from section through company level, night training, and mission peculiar training.

The techniques discussed in this manual are applicable, in varying degrees, to each of the three basic types of terrain in which warfare might be conducted. These are: (1) rolling to mountainous, vegetated terrain; (2) rolling, open terrain; and (3) arid, rolling terrain where trees and vegetation exist in depressions and along streambeds. The earth's surface is extremely varied. Therefore, the operational environment may dictate that certain techniques discussed in this manual be modified to better accomplish the task at hand.

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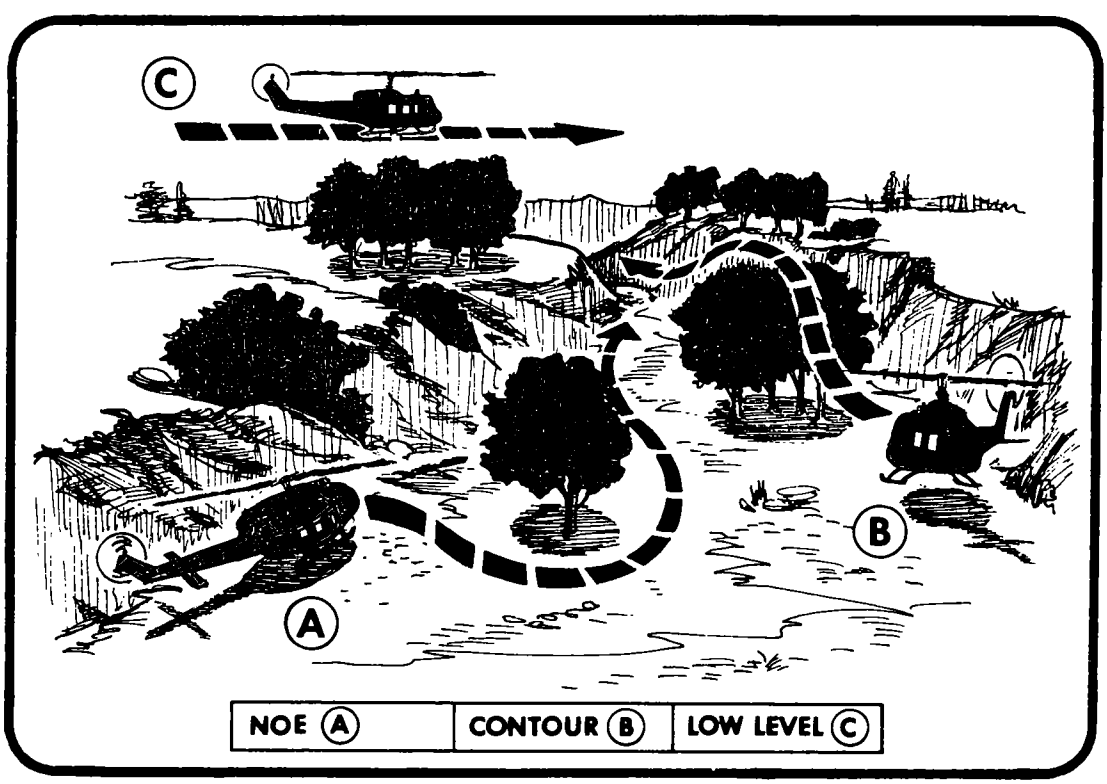
What Is Terrain Flying?

It is flight in the face of the enemy. It is to the aviator what creeping and crawling is to the infantryman - a means of survivability.

Specifically, *terrain flying* is the tactic of employing aircraft in such a manner as to utilize the terrain, vegetation, and man-made objects to enhance survivability by degrading the enemy's ability to visually, optically, or electronically detect or locate the aircraft. This tactic involves a constant awareness of the capabilities and position of the enemy weapons and detection means in relation to available masking terrain features and flight routes. Terrain flying of necessity involves flight close to the earth's surface and includes the tactical application of low level, contour, and NOE flight techniques as appropriate to the enemy's capability to acquire, track, and engage the aircraft.



Nap-of-the-Earth Flight

Nap-of-the-earth flight is flight as close to the earth's surface as vegetation or obstacles will permit, while generally following the contours of the earth. Airspeed and altitude are varied as influenced by the terrain, weather, ambient light, and enemy situation. The pilot preplans a broad corridor of operation based on known terrain features which has a longitudinal axis pointing toward his objective. In flight, the pilot uses a weaving and devious route within his preplanned corridor while remaining oriented along his general axis of movement in order to take maximum advantage of the cover and concealment afforded by terrain, vegetation, and man-made features.

Contour Flight

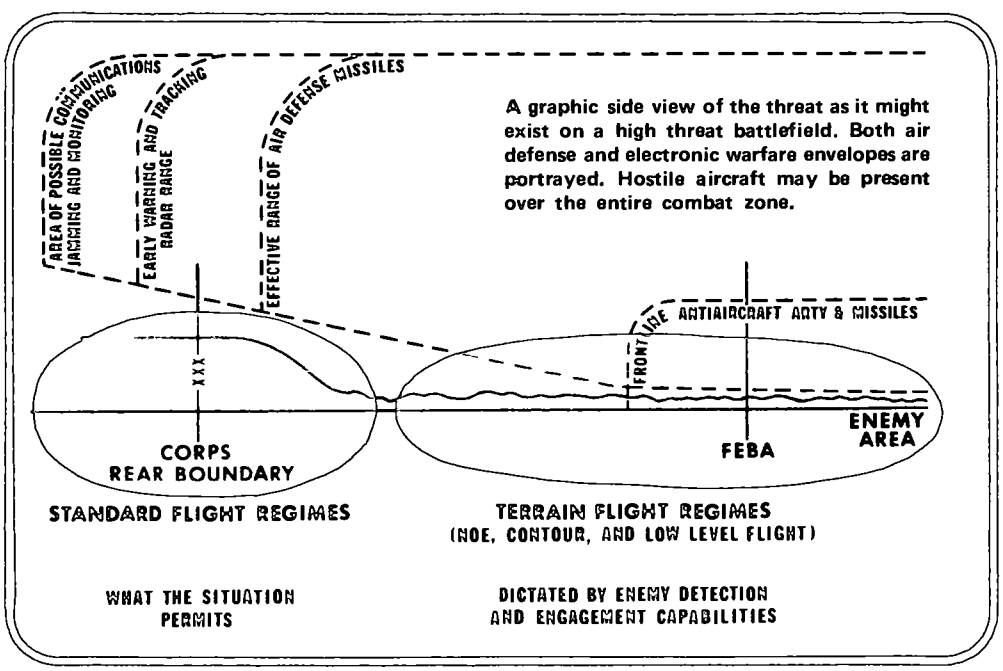
Contour flight is flight at low altitude conforming generally, and in close proximity, to the contours of the earth. This type of flight takes advantage of available cover and concealment in order to avoid observation or detection of the aircraft and/or its points of departure and landing. It is characterized by a varying airspeed and a varying altitude as vegetation and obstacles dictate.

Low Level Flight

Low level flight is flight conducted at a selected altitude at which detection or observation of an aircraft or of the points from which and to which it is flying is avoided or minimized. The route is preselected and conforms generally to a straight line and a constant airspeed and indicated altitude.

The preceding illustration and definitions provide a specific answer to the question: "What is terrain flying?" However, the answer is not complete because as an aviator you should also know when to use terrain flying and why you are using it. Figure I-4 provides a graphic description of when to use the terrain flight by comparing standard and terrain flight regimes to the threat. To answer "why," figure I-5 portrays your chances of survival in various flight situations against specific detection systems.

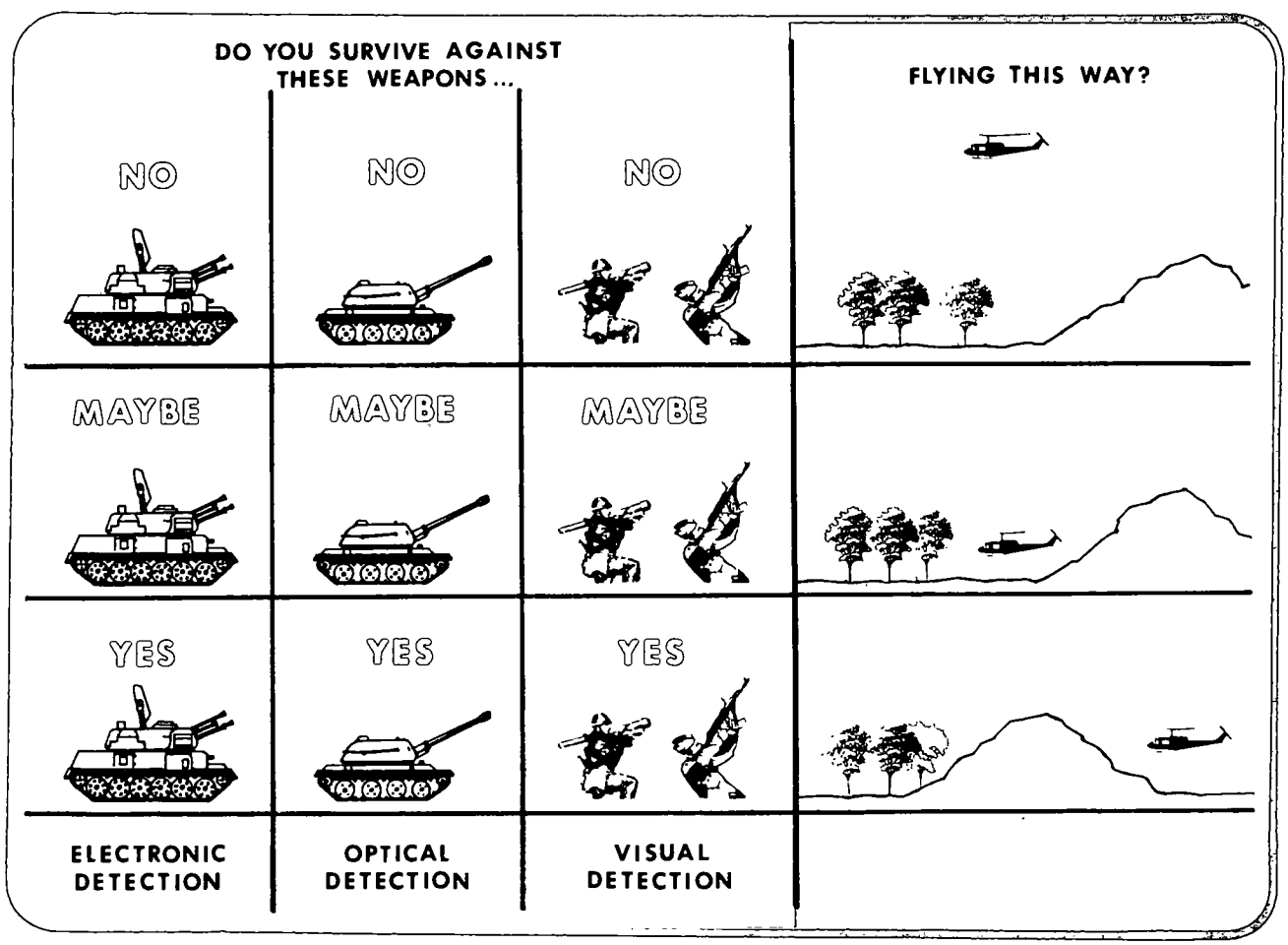
Figure I-4. Threat Profile.



The choice of whether low level, contour, or NOE flight will be used at a specific time and place will be determined primarily by the threat.

Whether the aviator will use low level, contour, or NOE flight, or a combination of these techniques, is influenced by three factors. First and most important - the threat and availability of masking terrain will dictate whether NOE, contour, or low level flight is used in a given situation by imposing maximum altitude restrictions. When no suitable terrain mass exists to provide masking so the aviator can fly low level or contour, he will fly NOE in order to take advantage of any vegetation and even the most subtle depressions in the surface. Secondly, time considerations influence the selection of a flight technique. When masking exists which allows contour or low level flight to be flown, either is usually preferable to NOE because more sorties can be flown or greater distances covered due to the high airspeed characteristics of low level and contour flight. The third consideration is safety. The higher the altitude, the greater the reaction time in an emergency and the higher the probability of obstacle and hazard avoidance. For that reason, the highest altitude below the masking terrain should be used.

Figure I-5. Survival Probabilities.



CHAPTER 1

Terrain Flying In The High Threat Environment

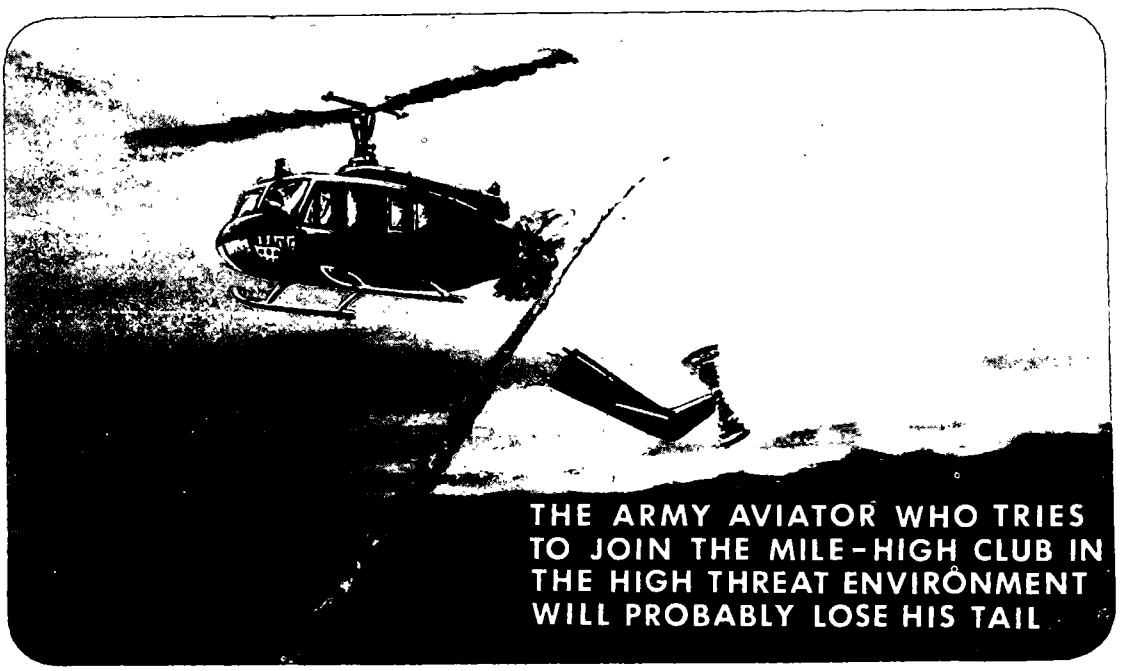
This chapter has two major functions. The first is to explain to the aviator that if he is to accomplish his mission in future wars he must employ new tactics. To do this, the chapter describes the combat environment in which terrain flying is employed and the threats we must operate against. The second major function of this chapter is to present fundamental techniques and considerations for performing terrain flight. Techniques discussed include, among others, multihelicopter operations, terrain flight planning and navigation, flight maneuvers, and inadvertent IFR procedures. Also, safety considerations are discussed and include hazard avoidance, aircraft maintenance standards, and weather. A final area discussed includes those human factors which impact on terrain flying such as fatigue and the use of peripheral vision for obstacle clearance and checkpoint identification.

1-1. THE HIGH THREAT ENVIRONMENT

The term mid-intensity is often used to describe conventional warfare employing the most modern technology and doctrine. However, this term belies the intensity of the conflict especially as it relates to aviation operations in future wars where we can expect to operate against a combination of sophisticated lethal threats. To more accurately describe this environment and to make the aviator constantly aware of the threat he will operate against, the term *high threat environment* is used throughout this and other texts written by the Aviation Center.

The high threat environment is an enemy combat posture wherein modern, sophisticated weapons and techniques create a highly lethal situation with the intention of establishing control over territory and airspace contiguous to that territory. Such a posture could include armor, field and antiaircraft artillery, surface-to-air missiles, and tactical fighters which would be directed by radar, infrared, optical, electro-optical, and visual means, and might be supplemented by electronic warfare methods to include interception, jamming, and deception.

Friendly tank, infantry, artillery, and aviation units will work together to accomplish the Army mission of conducting sustained land combat. To do this, ground fighting elements can add their fires to help suppress the enemy's air defense capability. The air defense umbrella provided by supporting and organic air defense units accompanying the tanks and infantry will assist aviation units in the area to survive against enemy aircraft. Friendly artillery should be used to degrade the enemy's surveillance capability and suppress his air defense weapons. While the ground forces help the aviation unit maintain freedom of movement, the aviation forces will provide the ground forces mobility, eyes and ears, and will help suppress the threats they operate against.



As the helicopter has become a more effective combat vehicle, the threats faced by Army aircraft have become more deadly. Early during the Vietnam conflict, air defense weapons were generally limited to small arms weapons and flying at altitude was a suitable tactic to counter this threat. However, during Lamson 719 and the 1972 North Vietnamese Spring Offensive, aviators saw the use of increasingly sophisticated air defense weapons such as radar-directed automatic weapons and heat-seeking missiles. Thus, in the late stages of that war, the few aviators who remained in country learned that they had to adjust their tactics to meet the threat. Especially in the northern provinces of South Vietnam where enemy positions became well defined, aviators began operating at low altitudes (less than 50 ft AGL) using terrain and vegetation to mask their movements.

During the 1973 Middle East War, a formidable air defense threat emerged that emphatically confirmed the terrain flying doctrine. In this high threat environment, heat-seeking missiles were used in vast quantities by frontline infantry; long-range radar-guided missiles provided an air defense umbrella extending well beyond the forward edge of the battle area; self-propelled, radar-guided air defense artillery was used to protect armor formations; and individual soldiers were well trained to utilize their small arms as air defense weapons. Although the helicopter was not used extensively by either side in this war, when it was used it generally operated at low altitudes utilizing the terrain to avoid detection.

Unlike the early days of Vietnam when Army aircraft were free to roam the skies virtually unimpeded, the threat that we must now be prepared to face has become much more sophisticated and intense. Today, only a properly prepared aviator and unit can successfully operate in the high threat environment. The aviation unit must function as a member of the combined arms team and utilize certain basic tactics. These tactics include terrain flying, night operations, limited communication, tactical instrument flight, and frequent movement. The success of a unit in combat will be directly proportional to its ability to operate as a member of the combined arms team and effectively employ the tactics listed above. Proficiency in these essential tactics is the key to winning the first battle of the next war!

GENERAL CONDITIONS FOR AVIATION OPERATIONS IN A HIGH THREAT ENVIRONMENT

- Units will operate as members of the combined arms team.
- Operations will be conducted in both nuclear and nonnuclear environments.
- Units will be required to conduct both day and night missions.
- Units will operate in adverse weather conditions.
- Enemy electronic warfare, especially jamming and voice deception, will be employed against aviation units.
- Units will often operate under conditions of radio silence.
- Attacks by enemy tactical fixed wing aircraft and helicopters can be anticipated.

Threat

The specific threats and employment doctrine against which we will operate in the high threat environment are discussed in FM 90-1, Employment of Army Aviation Units in a High Threat Environment. We face a threat not only when we are in the air but also when we are on the ground. The threat includes sophisticated air defense weapons and complementary electronic warfare, attacks by high performance aircraft and attack helicopters, and the use of artillery to destroy our maintenance facilities and rearm/refuel points. Basically, what the threat analysis tells us is that if we expose ourselves during flight the enemy can locate and hit us. Due to the lethality of his weapons, if he can hit us he

can eliminate us from the battlefield. *But he has the advantage only if we make the first mistake* - if we expose ourselves by not properly using the terrain, darkness, weather, suppressive fires, smoke, and radar deterrents (chaff, jamming). The combat experience of 1972 in Vietnam, the knowledge gained from the 1973 Middle East War, and the results of aircraft survivability tests have proven that terrain flying can minimize the effectiveness of the enemy weapons and weapon systems. Simply stated *terrain flying* is the fundamental element for mission success in the high threat environment.

Can you identify these threat weapons? Check your answers with the correct answers on page 36.

Figure 1-3.

1-2. TERRAIN FLYING CONSIDERATIONS

Terrain flying imposes additional factors on the aviator and unit that may not be encountered on missions flown at higher altitudes. Because these factors impact on mission planning and execution, it is essential that each aviator and commander understand them. These factors with their associated problems and ways to minimize or solve them are described below.

Terrain and Enemy Electronic Warfare Restrict Communication.

When conducting terrain flying, communications will often be limited or restricted. The line of sight radios currently available may be restricted by mountainous terrain and in certain cases it will be impossible to maintain contact with a unit outside the immediate vicinity of the aircraft. Since most communication with ground units will be with FM radio, the aviator must prepare during planning to operate around the limitations of the system. To do this, the aviator should identify those "dead areas" where he may not be able to communicate with his commander or supported unit due to terrain restrictions. The construction of a terrain profile diagram might assist in identifying dead areas. During certain operations, the commander may choose to assign aircraft, pathfinders, or retransmission equipment for radio relay purposes.

Alternate communication signals should be standardized.

In addition to the restrictions imposed by the terrain, it will often be essential in the high threat environment to limit communications due to the ability of the enemy to electronically locate the aircraft if it transmits. In the high threat environment, radio communications should always be limited to the absolute minimum and operating under radio silence will be very common. Therefore, alternate communication procedures must be developed for use between aircraft and ground units. Light signals and hand signals could be used for communication between aircraft. Marker panels, smoke canisters, and light signals could be used for communication between ground elements and the aircraft. To prevent confusion, all signals used should be standardized and protected against compromise. Even though the communication system may not be as responsive when conducting terrain flight, the effects of the lack of communication can be minimized with proper planning.

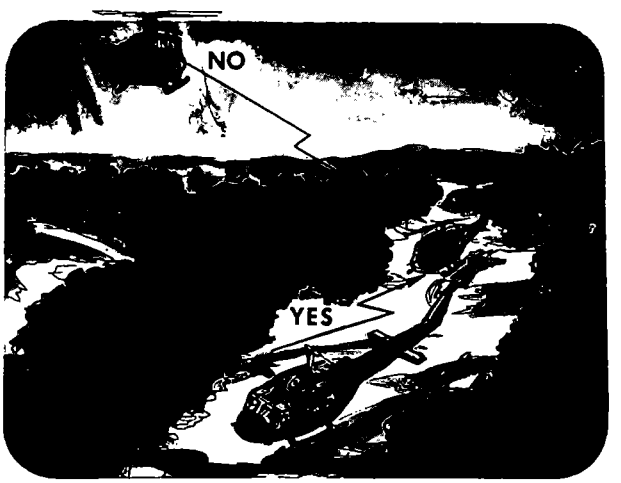
Lack of Communication Results in Decentralized Control.

The lack of communication when terrain flying causes a significant change in the procedures for control of a tactical operation. This affects both the ground and aviation commander. The ground commander will no longer be able to use his C&C aircraft to supervise the activities of several units simultaneously from altitude. Rather, he will have to use it primarily as a means of mobility between his units. Typically, aircraft communications will only be a supplement to his ground communications network. When communica-

tions are not limited, it is possible for the aviation commander to operate a centralized control system. However, when conducting terrain flying, control procedures will have to be tailored to the specific situation. The following conditions will normally apply to control of aircraft by the aviation commander:

- A commander's direct control over his unit will be limited by his ability to communicate with his subordinate elements.
- The aviation commander controlling the operation must participate as an integral part of the unit conducting the operation.
- When terrain flying, control will often be the responsibility of the platoon, section, or team commanders. They must be able to execute the mission as planned and, equally important, they must be able to make sound tactical judgments when the plan must be modified en route.
- Mission planning should be detailed and include primary and alternate routes. Control points and time should be used as control measures. Once the operation is underway, modifications to the plan must be held to the minimum necessary to accomplish the mission.

Control must come from within a unit, not from a commander circling high overhead.



In addition to communication and control, identification of friendly aircraft by friendly air defense and ground units is an area which must be considered in both mission planning and execution. It is critical that aviation missions be coordinated with friendly air defense artillery (ADA) units. Each aviator should be especially cognizant of the location of ADA units, know ADA unit criteria for identifying and engaging targets (visual recognition based on size, shape, markings, and color), and insure that onboard identification equipment (Identification Friend or Foe (IFF)) is functioning and properly coded.

Increased Maintenance Requirements.

When a unit is habitually conducting terrain flight, the commander should expect and plan for increased maintenance requirements. Blade strikes will probably increase, skin punctures may be more common, and maintenance inspections should be more timely and complete. The higher power settings required for NOE flight impose a heavy strain on aircraft dynamic components (e.g., engines, blades, and transmissions) that could result in reduced mean time between failure. In a combat situation, maintenance teams will be required to perform in the field maintenance when aircraft are operating out of forward positions removed from unit maintenance facilities.

1-3. MULTIHELICOPTER OPERATIONS

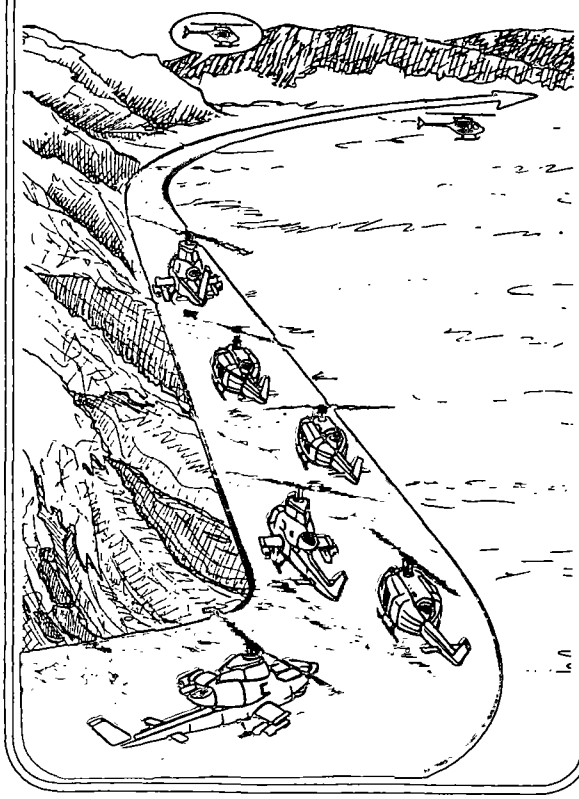
In the high threat environment, a formation's specific shape is defined by terrain, situation, and desired degree of control. Regardless of the specific formation, the aircraft will be staggered and the distance between aircraft will vary according to the terrain being crossed. Each aircrew in the flight is responsible for the accuracy of navigation and must be prepared to take the lead at anytime and proceed to the destination. Light signals and code words should be used to assist in reducing radio communications and in the event of lost communication or radio jamming by the enemy.

When terrain flying, the greater the number of aircraft in a group, the more easily they can be detected. In addition, a large group requires more terrain relief to remain masked than does a small group. When large groups of aircraft are required to accomplish the mission, dispersion can be achieved by using numerous routes into an area with small groups of aircraft utilizing each route. However, it will often be necessary to use a single route in order to concentrate available suppressive fires.

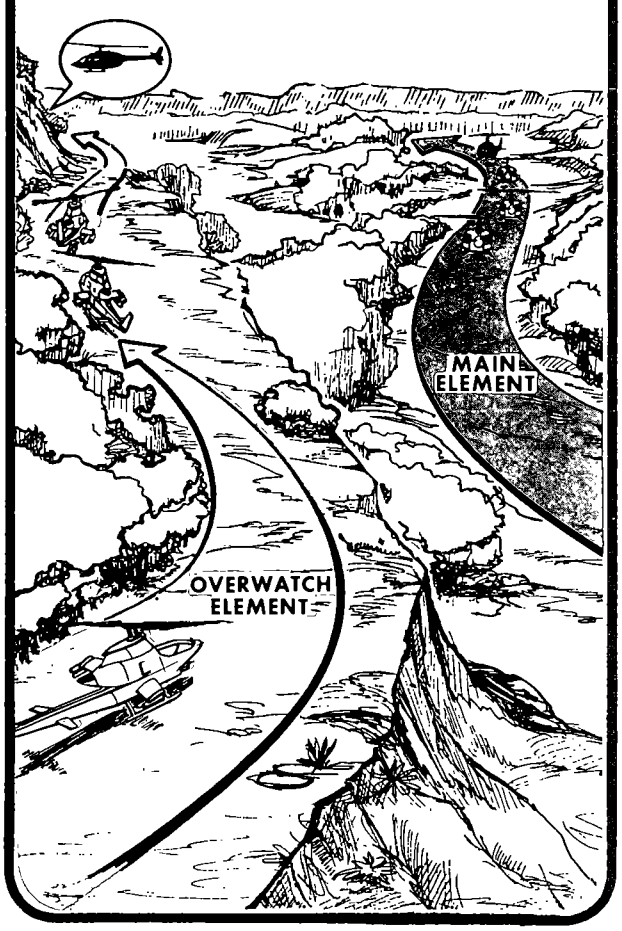
When moving, a small team of two or three helicopters should normally maintain its integrity so as to return an adequate volume of fire if attacked. Sections or larger units should employ traveling, traveling overwatch, and bounding overwatch as depicted in the following illustrations. When using nap-of-the-earth flight, individual aircraft within the formation (or element) move as do individual infantrymen in a squad. The squad leader picks the general direction of travel but each infantryman picks his terrain and moves by rushes or bounds within the loose formation. He is not required to step in the footprints of every man ahead of him. With aircraft formations, following aircraft pick their own terrain, moving by bounds independently from point to point within the formation. The pilot must be particularly careful not to maintain standard distances from preceding aircraft or exact flight routes which can aid enemy gunners. Each pilot must be aware of the situation, the terrain, and the mission. He must not follow blindly the tailpipe of the aircraft ahead.

If attacked, disperse immediately! Proceed, with each aircraft maintaining its own cover and concealment. Regroup when clear.

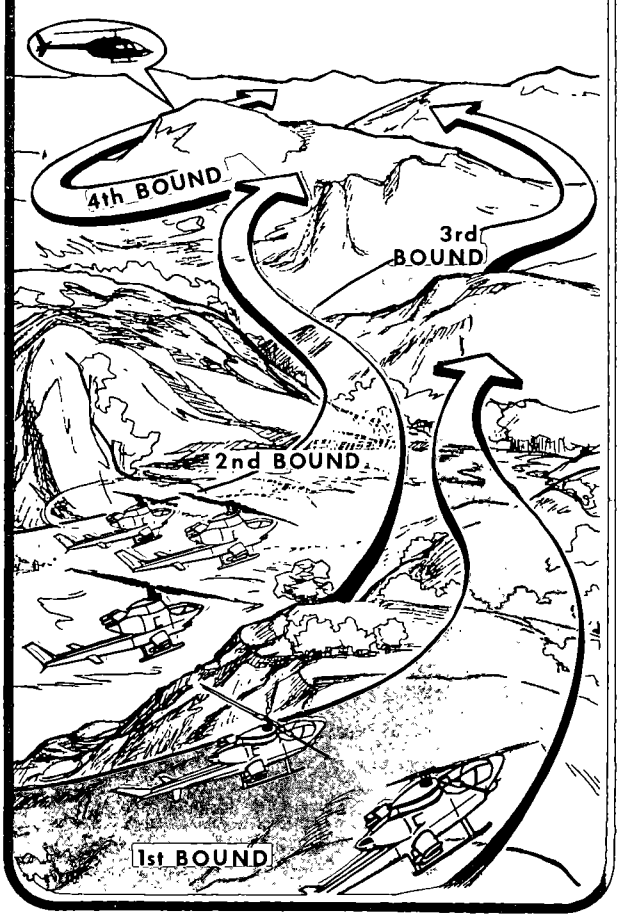
Traveling can be used when contact is *not* likely such as in corps and division rear areas. Low level flight will most often be used when employing the traveling technique. During traveling NOE and contour flight, the unit will normally move in loose trail or staggered trail. When low level flight is used, more formation flexibility is possible. The dispersion will be determined by the desired degree of control, visibility, terrain restrictions, and tactical considerations.



When contact is possible, *traveling overwatch* should be used. Traveling overwatch is characterized by continuous movement of the main elements (during an air assault operation, the lift platoons). The overwatch elements (the gunships) move at variable speeds and may even pause for short periods if necessary. The overwatching element keys its movements to the terrain and is always prepared to fire or maneuver, or both, to support the main elements.



At times it will be necessary for the aviation unit to employ a *bounding overwatch.* Elements move by bounds with one element in position to fire or maneuver, or both, before the other element moves. Once in position, the bounding element becomes the overwatching element and vice versa. This technique will be especially applicable in a situation where enemy contact is expected.



1-4. TERRAIN FLIGHT PLANNING

The requirement for accurate intelligence data (e.g., mission, enemy situation, terrain and weather, troops available, time, and space (METTS)) is fundamental to planning. During highly fluid situations, intelligence information can change rapidly. This requires that field reports be constantly evaluated, especially as they affect previous intelligence information related to the ability of the enemy to detect and engage an aircraft.

ACCURATE AND CONTINUALLY UPDATED INTELLIGENCE DATA IS REQUIRED FOR TERRAIN FLIGHT PLANNING.

Following the operations (G3/S3) and intelligence (G2/S2) briefing, the aviator will plot the selected landing zones, ambush and/or firing positions, aircraft control points, the FEBA, and known or suspected enemy positions. He will then select possible flight routes and alternate routes if not given in the mission briefing. The routes are then carefully studied to determine their susceptibility to visual or electronic detection by enemy forces. Altitude restrictions based on enemy threat analysis are then determined and marked on the map. The terrain in the immediate vicinity of the routes should be studied to familiarize the aviator with any potentially hazardous areas along his route of flight. Identified hazards will be marked on the map. Key terrain features should be noted along the route and especially at or near turning points. The aviator should, after performing the map reconnaissance, be able to visualize the entire route of flight. When available, current aerial photographs of the area should be used during the map reconnaissance to insure map accuracy and to check for hazards.

THOROUGH MAP STUDY AND THREAT ANALYSIS ARE ESSENTIAL FOR MISSION SUCCESS.

When planning a flight utilizing terrain flying, the aviator is actually planning detection avoidance. Unfortunately, the terrain does not always lend itself to our advantage for conducting terrain flight. Therefore, even when using NOE flight, there will be times when detection must be expected. This dictates that mission planning also provide for suppressive fires (attack helicopters, artillery, high performance aircraft, and naval gunfire), smoke, chaff, standoff jamming, or any other means available which can prevent the enemy from locating and/or attacking the aircraft. Whenever operating inside or near the range of enemy air defense weapons and/or artillery, the need for suppressive fires should be considered and, if necessary, requested.

PLAN FOR SUPPRESSIVE FIRES.

Whereas thorough planning and training are the keys to mission success, preplanning is the key to rapid response and flexibility. In order to retain these capabilities in spite of the greatly increased planning requirements inherent with tactical operations in the high threat environment, the aviator and aviation unit commander must plan well ahead. They must anticipate *what* may be required of aviation assets and *where* they may be needed. They must habitually start early a detailed map reconnaissance of likely areas of operation to determine possible routes of flight, landing zones, rearm and refuel points,

and the other elements essential for rapid and flexible response. To insure that ground and air tactical factors are coordinated and projected as far into the future as possible, they must work closely with the planning staff of the ground commander.

FLEXIBILITY WILL BE IN DIRECT PROPORTION TO PREPLANNING.

Route Planning Considerations

The first consideration in route planning is to know the local enemy threat and how he has been employing his air defense weapon systems. Routes can thus be planned to keep the highest possible terrain and/or thickest vegetation *between* the enemy and aircraft.

To do this in mountainous or rolling terrain, plan the route on the friendly side and below the crest of a ridgeline. In very gently rolling terrain, plan the route across the low terrain such as streambeds where it does not serve as an avenue of approach to the enemy position. In arid or open areas, plan the route along streambeds or depressions where trees may exist. When feasible, routes should avoid population concentrations due to the large number of hazards. Routes should not follow man-made linear features such as roads, canals, or pipelines unless required because of restricted visibility. These linear features normally do not follow a course which offers the greatest masking opportunity. To the maximum extent possible, routes should be planned over heavily vegetated areas as opposed to open terrain. This is especially true near enemy positions because the vegetation further restricts the ability of the enemy to detect the aircraft. Also, by flying over vegetation the aircraft shadow, which is the primary means by which high performance aircraft visually locate low flying helicopters, can be broken and lost in the darker vegetation. Because helicopters are susceptible to radar or visual detection on the side of a slope facing the enemy regardless of altitude, ridgelines should be crossed at low points. The ridgeline should be crossed so as to reduce exposure time to a minimum. When crossing the ridgeline, avoid silhouetting the aircraft on the horizon. Plan primary and alternate routes into and out of the objective area.

Checkpoints used along a route should be terrain features in preference to man-made objects. This is because man-made features are subject to change or destruction and unplotted features may be confused for intended checkpoints. When man-made objects are used, they should be used primarily to help confirm the identity of terrain features. To emphasize this point, the Canadian Army uses special maps during training with no man-made objects depicted on them.

Specific altitude restrictions should be determined for each route. When operating within range of enemy air defense weapons, maximum altitude is determined based on the masking offered by available terrain and vegetation. When operating beyond the range of enemy air defense weapons but within range of enemy surveillance equipment, altitude is determined based on friendly tactical considerations such as airspace management for aircraft, artillery, and air defense weapons. Friendly tactical considerations also include counterintelligence considerations. For example, altitude should be below enemy surveillance capability in the vicinity of command posts (CP), assembly areas, Forward Area Rearm and Refuel Points (FARRP's), etc., to prevent enemy radar from locating these positions because of the high density of traffic in the areas.

A note of caution is pertinent at this point. Route planning can only be as good as the map is accurate. In some cases, we may be working with an out-of-date map or maps on which the contour interval is too large to show terrain relief adequately. Therefore, changes to the route, based on observation of the actual terrain, should be made if necessary to remain masked.

ROUTE PLANNING CONSIDERATIONS

SUMMARY

- Keep a terrain mass and/or vegetation between the enemy and the aircraft.
- Avoid using man-made objects as checkpoints.
- Do not follow man-made linear features.
- Avoid silhouetting the aircraft when crossing ridgelines.
- Plan primary and alternate routes.
- Avoid open areas when terrain permits.
- Determine altitude restrictions based on threat, masking offered by the terrain, and friendly tactical considerations.

TERRAIN FLIGHT PLANNING EXAMPLE

MISSION: An aircrew is assigned the mission to pick up a TOW team near the FEBA (FK 088898) and insert the team at FK 039984 and bring two men back to the PZ (FK 088898).

SITUATION: The US Forces are presently in a mobile defense southwest of Brundidge (see map A (insert)). The FEBA generally runs along the ridgeline west of the Pea River. The general outpost (GOP) is approximately 15 kilometers northwest of the Pea River where the division's armored cavalry troop is deployed. An enemy mechanized division, operating from its headquarters near Spring Hill (EL 9806), has been observed deploying its tanks and self-propelled antiaircraft weapons along Highway 125 and adjacent roads near Tarentum (FL 0601) and as far south as the intersection at FK 063977. A cavalry troop aeroscout has reported ZSU 23-4 and SA7 positions at FL 039018 which have clear fields of fire on aircraft approaching the GOP.

PLANNING: Using all intelligence information available to him and making a thorough map study during his premission planning, the pilot determines his best course of action along with alternate courses of action should the situation change en route. He determines that because of the high ridge on the south side of the Pea River, which will mask his approach from the enemy, he can fly at contour altitudes from home base (located off the SE corner of the map) to the ridge (FK 136883). He further determines his route of flight from the PZ to the LZ (sketched on map) and back to the PZ. The route is selected to follow the low terrain, cross ridgelines at low points, and make maximum use of vegetation to remain masked from optical and electronic observation by all known and suspected enemy locations. In order to remain masked, the pilot decides to employ NOE flight after crossing the ridgelines on the south side of the Pea River. He indicates on his map with arrows the wire hazard which crosses the route. He will depart the LZ at 1035 local time. Artillery (HE and smoke) will be available on call for suppression of known enemy locations.

1-5. PERFORMING TERRAIN FLIGHT

The manner in which the pilot performs terrain flying is directly influenced by his mission. The scout who is searching for the enemy will use NOE extensively. He will sneak and peak, dash across open fields, and use many other techniques which the cargo pilot will seldom, if ever, use. Even with the differences in the way terrain flying will be conducted for any given mission, there are three fundamental elements necessary to successfully conduct any terrain flight. These are crew integration, navigation, and aircraft handling.

Crew Integration

Terrain flying is a crew activity conducted by at least two qualified aviators or an aviator and a qualified aeroscout observer. A qualified aviator is one who has completed an authorized terrain flight qualification training program such as outlined in this manual and meets all other required criteria to perform flight. To be considered qualified to function as a member of a crew conducting terrain flight, an aeroscout observer must have successfully completed all aspects of an authorized terrain flight qualification training program except those tasks only a rated aviator can perform. This training is necessary to train the observer to assist the pilot by navigating and to familiarize the observer with the high threat environment. This training is in addition to other training the aerial observer receives.

Terrain flight is a crew activity. It can only be performed successfully with teamwork!

During flight, the division of duties is well defined. The pilot must concentrate on clearing obstacles and maintaining direction and airspeed. He must be free to keep his vision outside the aircraft at all times. The copilot/observer is responsible for accurate navigation. He must remain oriented at all times and inform the pilot of the direction to be flown and requirements to increase or decrease speed in order to arrive at the next checkpoint on time. He also assists the pilot by monitoring instruments and tuning radios. Position reports should normally be made by the copilot/observer.

A cockpit SOP should be established prior to conducting terrain flying. This SOP should include the division of duties/responsibilities and the following additional points:

- *Mission essential equipment* - In addition to the required flight and protective clothing, and emergency and survival equipment normally carried onboard an aircraft, onboard equipment should include local area maps, CEOI, and a -10 operator's manual.
- *Power checks* - Engine health indicator tests should be conducted in accordance with unit maintenance SOP. A hover check will be conducted prior to each takeoff and an out-of-ground effect hover check will be conducted prior to NOE flight.
- *Safety precautions* - There will be no smoking by either the crew or passengers when conducting terrain flying. Under most conditions, crewmembers should wear their visors down during flight. The visors must be clean and free of scratches. Armor plate should be in place. During terrain flight, all personnel will be seated and restrained by belts. Exceptions to this policy during tactical operations should be made only in accordance with unit SOP by the pilot in command.
- *Inflight emergency procedures* - Emergency procedures should be established by each crew prior to conducting terrain flight. Due to the critical shortage of time for the crew to react to an in-flight emergency, each member of the crew should know what he will do in the event of an emergency. There is normally not enough time to transfer aircraft control during an emergency requiring autorotation when terrain flying. Therefore, an attempt to transfer controls should not be made. The crewmember not flying will make the emergency radio calls.

Navigation

Experienced aviators have navigated successfully at altitude and most of us think that we can satisfactorily transfer this skill to accomplish navigation at terrain flight altitudes. This unfortunately is not true as indicated by the following quote from the US Army Research Institute report entitled "Navigational and Flight Proficiency Measurement of Army Aviators Under Nap-of-the-Earth Conditions." The high experience group referred to in the quote below had a mean flight experience level of 1378 hours, while the low experience group had 214 hours.

> "The basic lesson to be learned from these data is that flight experience per se does not yield better performance in a highly specialized task like NOE navigation. It is hypothesized that the low experience group performed better because it had recently received, as part of its undergraduate tactics course, an NOE flight familiarization sequence. The high experience group had received its NOE training 'on the job' at unit level. In fact, some of the high experience group had received no real NOE training at all."

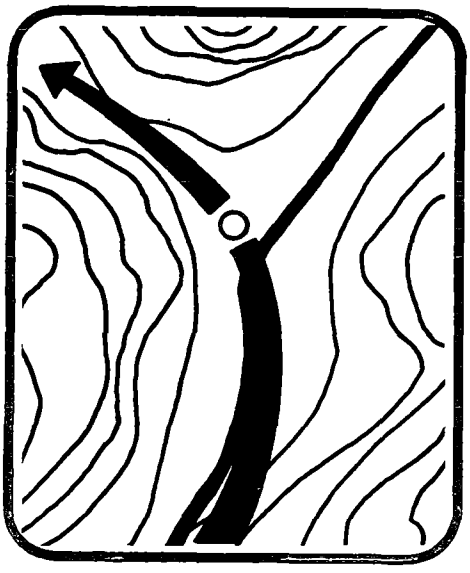
To successfully navigate, the aviator must be able to visualize the actual terrain as depicted on a map.

Terrain flight navigation is difficult because the flat visual angle distorts shape compared to the map and because vertical relief is the most suitable means of identifying checkpoints. To conduct terrain flight navigation with proficiency requires training and practice. Checkpoint identification is the critical task for successful terrain flight navigation. This requires that the crewmember navigating be proficient in map reading, terrain interpretation, and terrain/map correlation. He must be able to visualize from the map how the terrain around him should appear. He must also be able to look at the terrain, identify his location, and then locate that position on the map. The

navigational difficulty is greatest when NOE because the aviator navigates primarily by vertical relief which must be interpreted from the map. Low level navigation is easier because at the higher altitudes associated with low level flight, the aviator can more accurately identify shapes which are depicted directly on the map.

Terrain flight navigation requires an exchange of information between the crewmembers. The crewman navigating furnishes the pilot with the information that is required to remain on course. To assist the crewmember navigating, the pilot points out approaching terrain features. Standardized terms should be agreed upon to identify terrain features because terrain features are often identified by different names in various parts of the country. For example, a body of water called a creek in some parts of the country might be referred to as a stream or brook in other areas. Standardized terms will help prevent misinterpretation of information and reduce unnecessary cockpit conversation.

Certain aspects of terrain flight navigation differ depending on whether low level, contour, or NOE flight is being performed. Because terrain flying will normally involve a combination of these flight techniques during any given flight, the aviator must be familiar with the navigational techniques associated with all three.



A turning point.

NOE navigation requires continuous orientation unlike contour and low level navigation when the aviator follows the desired route by identifying a series of successive checkpoints. To remain continuously oriented, the crewmember navigating must identify all terrain features depicted along his route on the map with the actual terrain feature. This requires that he be highly proficient in map/terrain correlation and that he and the pilot work together as a team. Specific techniques for providing the pilot NOE navigation instructions are discussed below:

- When possible, the pilot should be told to follow an identifiable terrain feature such as a streambed, draw, or spur.

- Guidance information should be provided to the pilot in small increments. Generally, it need not be provided beyond the next turning point. A turning point is a point where the route makes a major change in direction. Several terrain features should be used to identify a turning point to prevent confusion.

- Heading information should be provided in such a manner that the pilot does not have to focus his attention inside the

cockpit. He should be told to turn to a "clock" position or recognizable terrain feature or tree. "Rallye terms" such as "... turn left, start turn, stop turn. . ." can be used when necessary. Rallye terms are single words or pairs of words which describe a particular action and are used to tell a pilot what to do to follow the course rather than where to go to follow the course.

■ The pilot should not be told to fly a specific airspeed because this requires him to look in the cockpit. He should be told to increase or decrease airspeed.

Whereas NOE navigation requires precise following of a well defined route, contour navigation is less precise because the contour route is more sweeping. This does not mean that contour navigation can be sloppy - it can't. Since the contour route is planned to utilize the terrain to achieve cover and concealment, it must be followed closely. Due to the constant (and generally high) airspeed which characterizes contour flight, checkpoints on the route should be spaced according to the planned airspeed to be flown and should be easily identifiable.

When performing contour flight, the pilot and the crewmember navigating must work together well. As with NOE, it is important that the pilot focus attention outside the aircraft and not be required to use the instruments to follow navigation instructions. The most effective technique for providing navigation instruction is to combine the use of terrain features and rallye terms (fig 1-13). The crewmember navigating is also providing the pilot with airspeed information so that checkpoints are crossed on schedule.

Many of the techniques relating to NOE and contour navigation are applicable for low level navigation. However, several techniques can be used for low level navigation which cannot be used for contour or NOE navigation. Computed time-distance can be used effectively for low level navigation since low level flight is characterized by constant airspeed and distance can be accurately measured. The pilot can be told to fly specific headings and airspeeds since he has increased reaction time and obstacle clearance. Also, radio may be an effective navigation aid.

Procedures for navigating when terrain flying and related techniques for map preparation are discussed in more detail in FM 1-5, Instrument Flying and Navigation for Army Aviators.

When contour flying the crewmember navigating should point out to the pilot a prominent terrain or man-made feature some distance ahead of the aircraft and along the course. Rallye terms can then be used to provide the pilot the information he needs to follow the exact course.

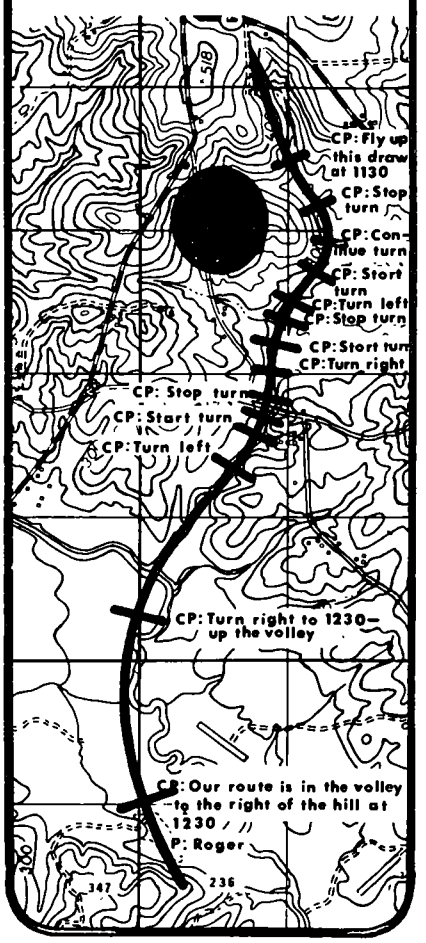


Figure 1-13.

Aircraft Handling

To perform terrain flying, the pilot must handle his aircraft with skill and finesse. Aircraft handling is a much more critical task when terrain flying than when flying at altitude because the pilot is flying in much closer proximity to terrain, vegetation, and hazards. This requires that the pilot be acutely aware of the dimensions of the aircraft and the time it requires for the aircraft to react to the pilot's input.

When operating at near gross weight the pilot's aircraft handling skill will be severely tested. Because he is operating close to vegetation, often at slow airspeeds or hovering, the pilot must know the performance capabilities and limitations of his aircraft. He must plan his mission correctly, employing the -10 performance charts, and adhering to the go/no-go takeoff data placard in the aircraft.

Aircraft handling also involves the skill of the pilot to judge obstacle clearance. He must be able to quickly and accurately decide when to go over obstacles rather than between or under them. He must know how to use vegetation and shadows to reduce glare.

Another critical task relating to aircraft handling when terrain flying is that flight maneuvers be executed precisely. The specific flight maneuvers required to perform low level and contour flight differ only slightly. However, certain flight maneuvers required for NOE flight differ significantly from low level and contour flight maneuvers. For example, to stop abruptly when NOE (a quick stop), the aircraft must pivot around the tail rotor's horizontal plane (fig 1-15). This requires that power be increased prior to beginning the deceleration so that the nose comes up and the tail doesn't drop. The amount of power applied is dependent upon forward airspeed and load on board the aircraft. Specific procedures for conducting the quick stop and other basic NOE flight maneuvers are discussed in appendix C.

Certain emergency procedures (i.e., engine failure, antitorque failure (especially a complete loss of thrust), low side governor failure, and hydraulics failure) become more critical when terrain flying. Most aviators need additional training to satisfactorily cope with emergency situations at the low altitudes associated with terrain flying, especially NOE. The aviator must be able to perform low level and hovering autorotations safely. He must be able to discuss the procedures for dealing with engine failure, low side governor failure, and loss of antitorque thrust at low altitudes and slow airspeeds. He must also be able to discuss procedures for hovering autorotations between 50 and 100 feet AGL.

Emergency situations when terrain flying require instinctive reactions.

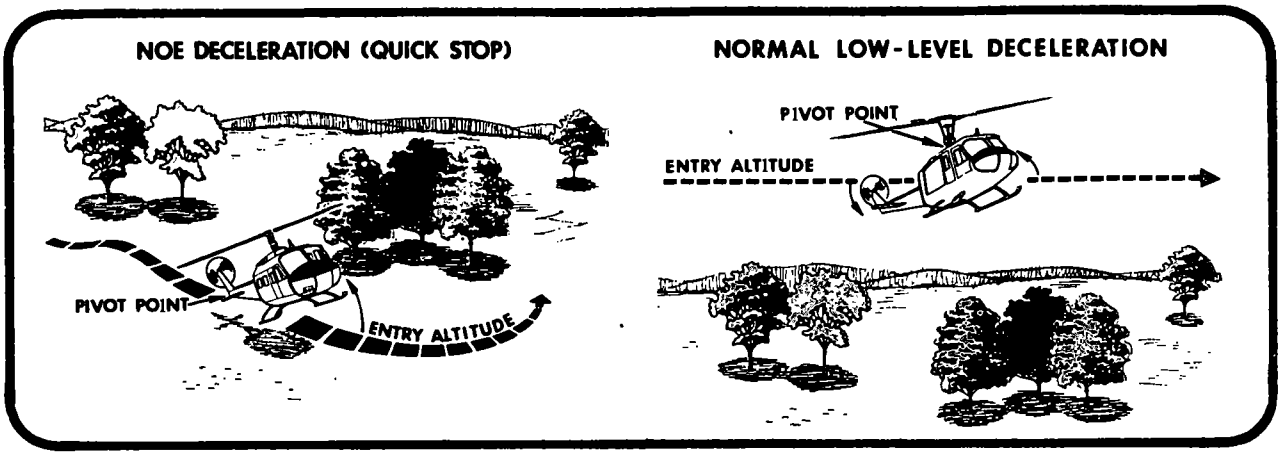
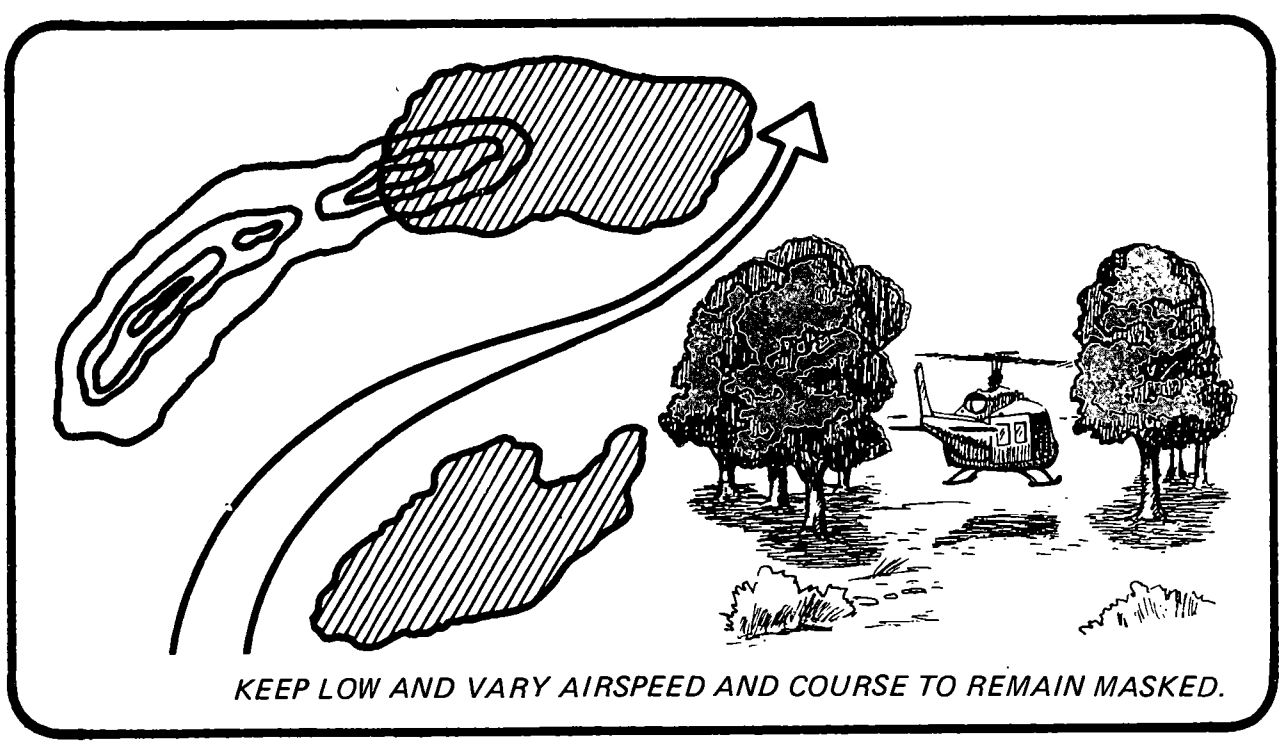


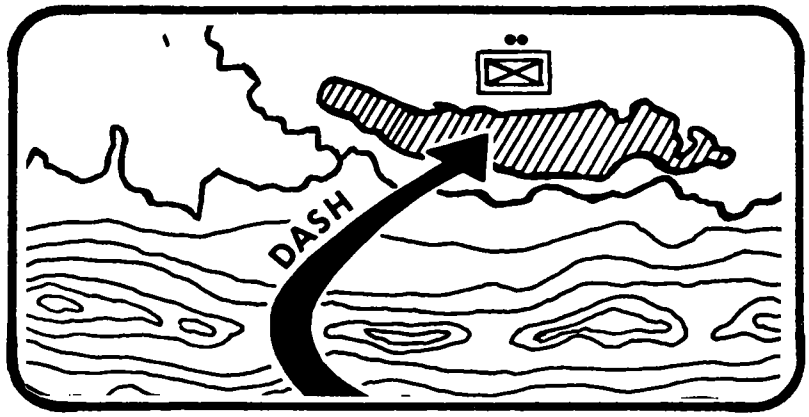
Figure 1-15.

How to Move

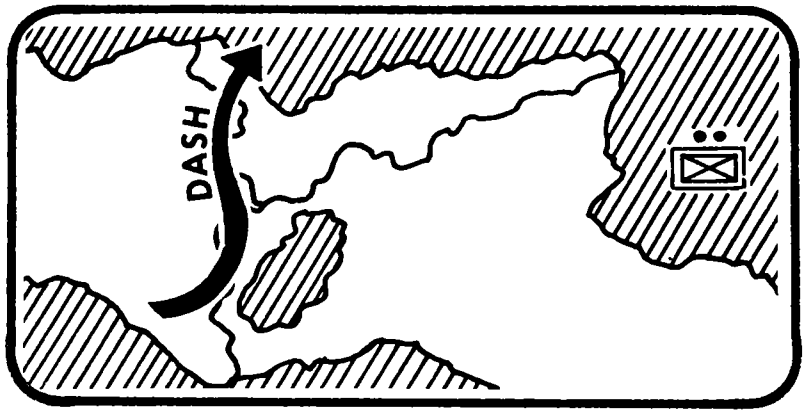
The rules depicted on this and the next two pages will aid the pilot in moving about the battlefield undetected, especially when searching for the enemy or when enemy positions and capabilities are unknown. The rules presented are applicable to single ship and small group movements. As practical, these rules should also be employed when moving in a large group.

The cardinal "how to move" rule is -

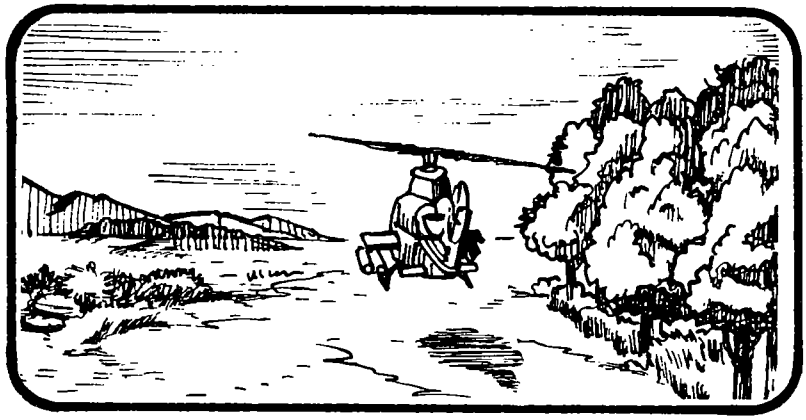




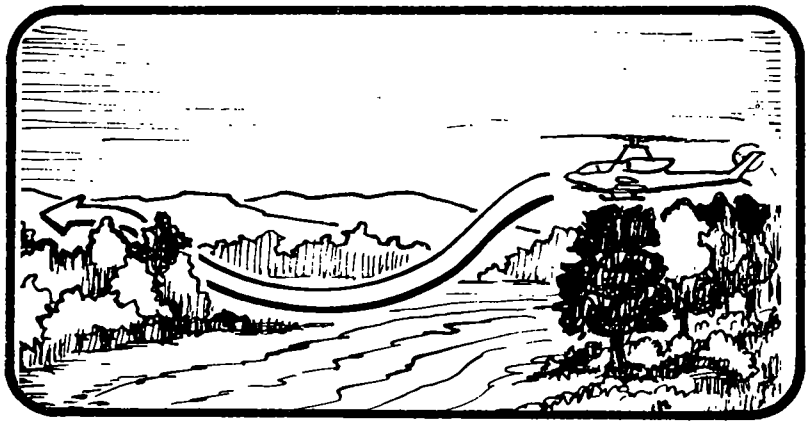
When crossing a ridgeline which may be exposed and can't be bypassed, pick your way to the lowest crossing point, dash across the forward slope to the next cover.



When crossing open flat areas, cross at the narrowest point and dash across, moving constantly. Try to keep vegetation between you and the enemy and follow low terrain. Remember, keep your exposure time to less than 10 seconds.



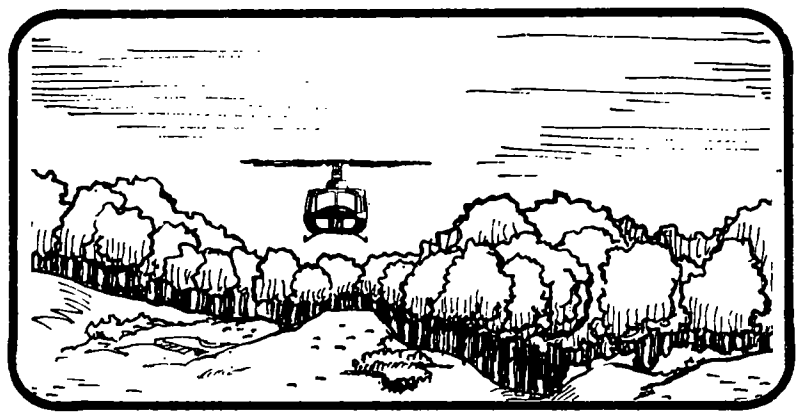
When paralleling a vegetated area fly below and near the vegetation.



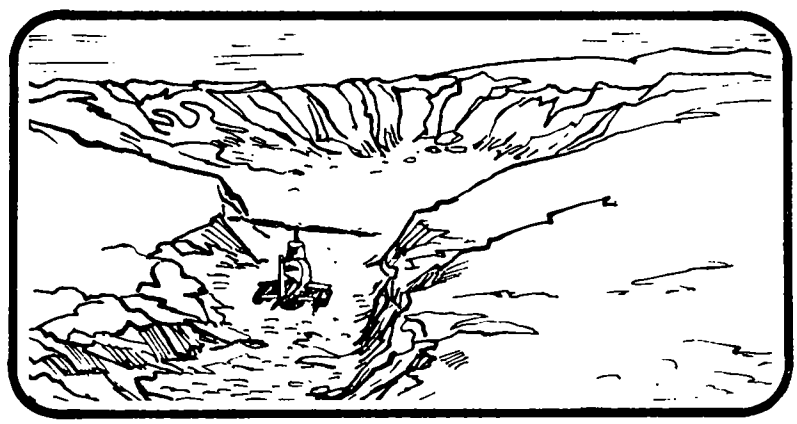
Decrease altitude when overflying fields and other open areas.

Hover or land whenever necessary to reconnoiter an area prior to proceeding. If necessary, dismount! Try to look through or around vegetation rather than over it.

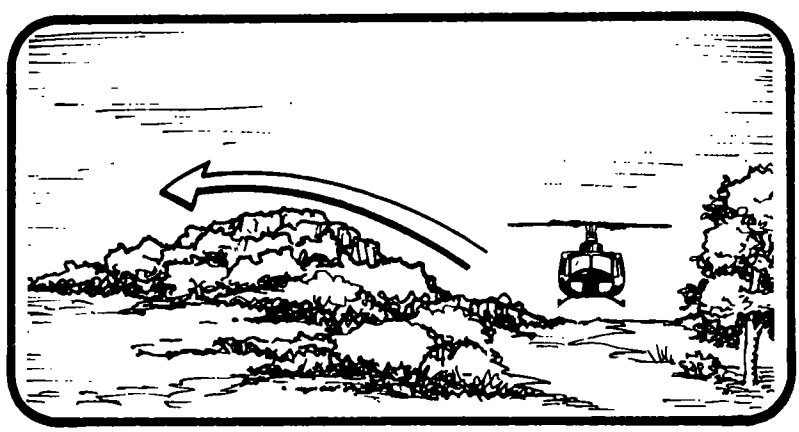
When flying over dense vegetation, follow the lowest contours of the vegetation rather than the lowest contour of the earth.



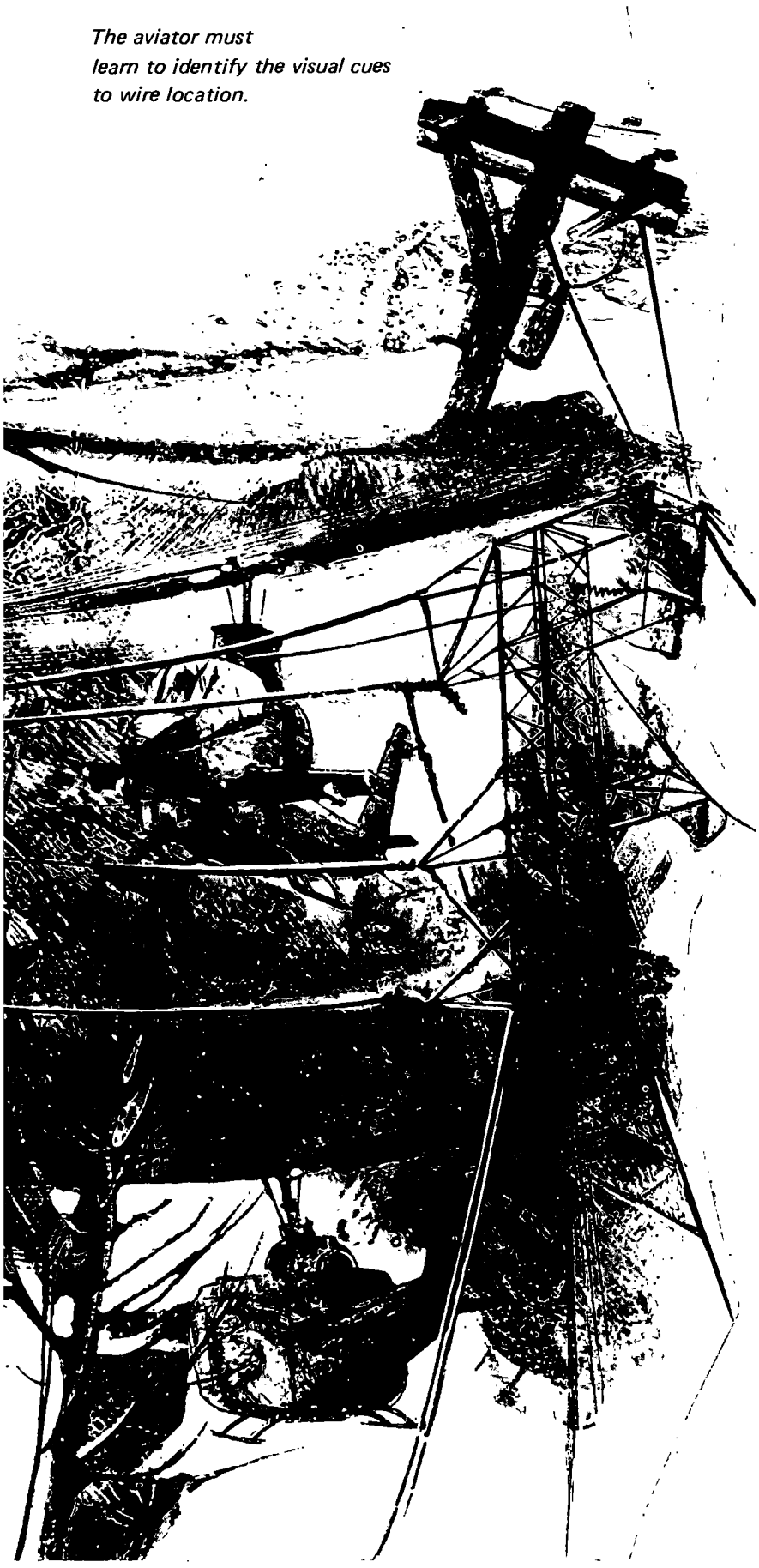
Do not fly into a situation where you have no room to maneuver if attacked.



Always have an evasive maneuver planned if attacked. CAUTION: Never turn your tail directly toward the enemy if any other choice exists.



The aviator must learn to identify the visual cues to wire location.



1-6. BATTLEFIELD FLIGHT SAFETY

On a battlefield where we may be highly outnumbered, we cannot afford losses caused by accidents and carelessness. Safety must therefore come second only to mission requirements when conducting terrain flying.

Physical Hazards

When conducting terrain flying during tactical operations or training, a number of wire hazards must be contended with - some of which are powerlines, communications wire, TOW missile guidance wire, and fences. Wire strikes have been and are a significant hazard to Army aircraft. To minimize the danger of wire strikes, each aviator should make a detailed map study prior to each flight specifically to identify and mark wire hazards. After each flight, unmarked wires should be plotted on a hazards map (the hazards map is discussed later). When communications wire is laid by aircraft, the route should be plotted on the hazards map. Areas in which large numbers of TOW missiles have been fired from aircraft and in which the wires may be resting in the tops of trees should be identified.

Attempts to provide the aviator with a reliable means of detecting and/or coping with wires have been and are continuing to be made by Army research activities. However, the availability of such systems is not foreseeable in the near future. Presently, the only means of coping with wires when conducting terrain flight is to avoid them. This requires map and aerial photo reconnaissance, maintaining an accurate hazards map, and

understanding the relationship between airspeed, wire detection, and avoidance. Because wires themselves often cannot be seen until it is too late, the aviator must learn to identify the visual cues to wire location - look for the swath through the vegetation on aerial photos, spot poles during scanning, and expect wires along roads, near towers, and in the vicinity of buildings. Slower airspeeds in unreconnoitered areas must be emphasized to avoid wire strikes. Suggested guidelines for crossing wires are presented later in this paragraph.

In addition to wires, there are other physical hazards such as trees and birds with which crewmembers must cope. Helicopters are particularly vulnerable to blade strikes at NOE altitudes. Therefore, aviators must insure clearance during flight and when using trees for masking and unmasking maneuvers. Also, a dead tree or tree without leaves which is taller than the surrounding vegetation is easy to miss if the pilot constantly focuses his attention too far ahead of the aircraft. Bird strikes can cause damage to the aircraft. As a rule of thumb, the pilot should not try to avoid birds unless they are in a very large flock. Generally they will avoid the aircraft. To guard against personal injury from tree branches or birds striking and shattering the plexiglass, crewmembers should wear their visors down and insure that aircraft armor is in position.

When terrain flying, *the most important factor in hazard avoidance is for the pilot to keep "his head out of the cockpit."* He must use the proper visual scanning technique (discussed in paragraph 1-8), interpret visual cues, and recognize blind spots from which other aircraft might be approaching (or setting up an ambush).

The development and maintenance of an accurate and complete hazards identification map by each aviation unit covering those areas in which it operates and trains is *essential* for aviation safety. Maintaining the hazards map should be the responsibility of a specified individual in the unit. The map should depict all established routes and the hazards encountered along those routes. When the hazard is a linear (wire) rather than spot feature, the entire route of the hazard through the area should be marked. Each aviator will mark all hazards which affect his route or routes on the map that he will use in the aircraft.

A hazards map showing hazards within the area of operation must be maintained by each unit and updated after each flight when an unplotted hazard is located.

Weather Hazards

Weather can also be a hazard if proper precautions are not taken. Any time visibility is reduced because of flight into the sun or adverse atmospheric conditions (haze, drizzle, fog, rain, or snow), altitude must be increased and/or airspeed decreased to provide the aviator added reaction time to avoid obstacles. Flight into the sun is particularly tricky - planning should avoid flights into the sun whenever possible. This is extremely important when contour flying because of the aircraft's high airspeeds and close obstacle clearance. In a combat situation, it will not always be possible to increase altitude because of enemy air defenses; so in this case, airspeed would have to be reduced. Exiting from a thermal can be dangerous if the pilot does not anticipate the loss of altitude. This is especially dangerous when terrain flying with loads.

Terrain flying in winds in excess of 30 knots, downwind between 15 and 30 knots, and when gust spread exceeds 15 knots, requires a greater power reserve (i.e., less weight can be carried) for safe flight. Unit SOP should prescribe a reduction in allowable cargo load in the conditions described above.

Because of the low altitudes associated with terrain flying, there is absolutely no margin for maintenance error. Also, stringent preflight, postflight, and periodic inspection standards are essential for safety.

Maintenance

When conducting terrain flight, proper maintenance of the machine is of the utmost importance. The aircraft must be constantly maintained in peak condition to insure reliability. Personnel must perform by-the-book inspections and take necessary and prompt action to correct any problems encountered. During postflight inspections, special emphasis should be placed on inspection of the rotor blades, bottom fuselage, tail boom, and tail rotor for tree strike damage. To aid in avoiding maintenance problems, aviators should thoroughly understand why certain components are checked during preflight, runup, shutdown, and postflight and what the consequences would be if a component failed to function properly during flight. Aviators must insure that any deficiency discovered during inspection is entered and accurately described on DA Form 2408-13. Especially when NOE flight will be flown, commanders must select the best aircraft available from both a structural and mechanical standpoint. He must also insure that sufficient time is allowed for the aircraft to be continually maintained in the best possible conditions. Using aircraft that have a past history of maintenance problems, particularly with the engine or transmission, is asking for trouble. Windshields are another area of concern and must be cleaned at least daily to avoid any obstruction to visibility. Windshields scratched to the extent that they are unacceptable for night flight should not be used when conducting terrain flying, especially NOE.

Wire Crossing Guidelines

Wires are a significant hazard to aircraft when terrain flying because they are difficult for the pilot to see. To locate the wires is the pilot's most critical responsibility. Once he has located the wires, he can cross them safely using the techniques described below.

The safest way to cross wires is by overflying them at a pole. This is because the pole can be seen more easily than wires. However, the pilot must beware of the guy wires supporting the poles. The next safest way to cross wires is by overflying them between poles. When doing this, the pilot must positively identify the highest wire prior to crossing. The highest wire is often a wire between the tops of two poles and is usually very difficult to see.

In combat, it may be necessary for the aviator to underfly wires to prevent exposing himself to enemy visual or electronic detection. Flight between two wires or sets of wires should not be attempted. When the tactical situation requires that wires (or other man-made structures) be underflown, the aviator must insure that enough clearance exists to provide for extreme aircraft height (if level), plus hover height, plus a "margin for error." *Caution: The highest point of most helicopters is at the rear of the main rotor tip path plane or the high point of the tail rotor arc. During forward hover, this point is higher than when the aircraft is level because the aircraft is in an accelerating attitude. Since the aviator can't determine the exact height of the highest point, he must allow for a height increase along with possible judgment errors relating to hover height and wire height when he determines his margin for error.*

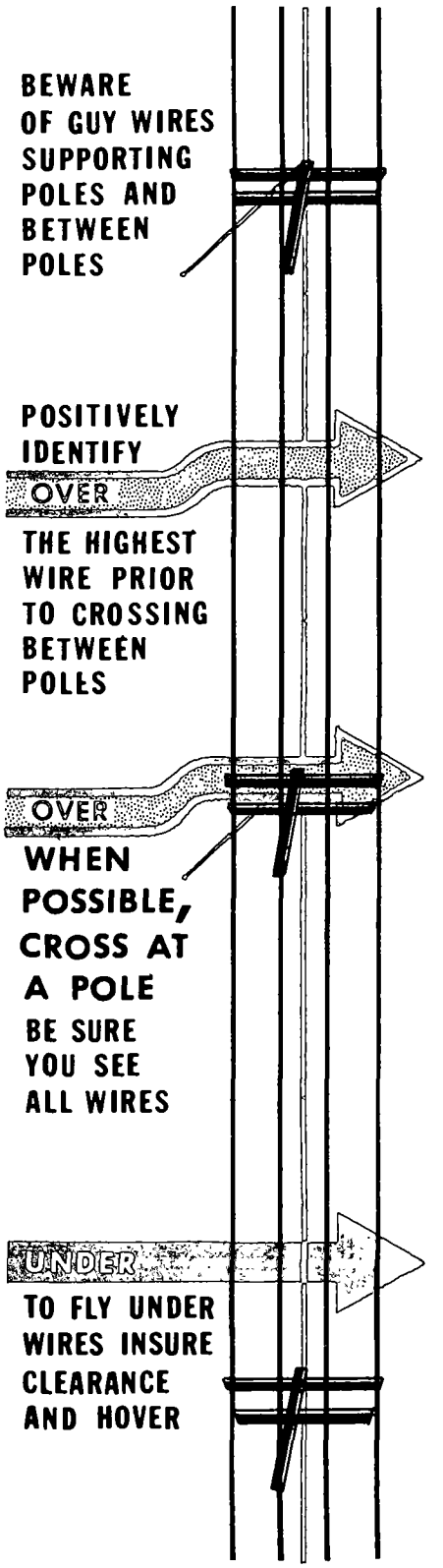
When underflying wires:

- Airspeed should be no greater than hover speed (brisk walk).
- Cross near a pole because the wires are higher and the pole aids visual perception. However, insure lateral clearance from guy wires and poles.
- Use another aircraft or a dismounted crewmember as a guide if clearance is marginal.
- If a pilot suspects that a rotor blade has hit a wire, he should land and inspect for damage and wire entangement.

Minimum Clearance Requirements	
OH-58	20 feet* + hover height
OH-6	17 feet* + hover height
UH-1	25 feet* + hover height
AH-1	25 feet* + hover height

*Extreme aircraft height, aircraft on the ground, flight controls neutral plus a ten foot margin for error.

To underfly wires safely, the pilot must estimate accurately the clearance of the wires above the ground. In some cases, there is no doubt that the wires are high enough to insure clearance; in other cases, a judgment will be required. Therefore, it is important that the aviator receive training in estimating clearance. This can be done by having the aviator estimate clearance of wires at selected sites in the training area. The actual clearance should be known. Also, slides showing wires with known clearance can be used for training in an academic environment. It is suggested that aviators be required to make between 40 and 50 correct clearance estimations to develop proficiency.



1-7. TERRAIN FLYING IN ADVERSE WEATHER

The staying power of Army aircraft is increased significantly when aviators and units are so well trained that they can perform terrain flying in adverse weather. The capability of a unit to conduct terrain flying in adverse weather must be highly developed because during war Army aviation units must perform both day and night and in good and bad weather. In adverse weather the aviation commander must carefully weigh the mission requirements against the capabilities of his equipment and the state of training of his aircrews.

Terrain flight can be conducted successfully in adverse weather so long as sufficient visibility exists to navigate accurately and allow obstacle avoidance.

There are two major aspects peculiar to adverse weather that influence the ability of the pilot to conduct terrain flying. They are ceiling and visibility. Low ceiling and poor visibility can be assets when flying in the high threat environment. Reduced visibility is an asset because the enemy's optically and visually guided antiaircraft weapons will be less effective or even neutralized. In addition, IR seeking missile's effectiveness will probably be reduced. This is because the target must be optically acquired and in low visibility the enemy can often hear the helicopter but will not be able to pinpoint its location or judge its heading or distance by sound. A low ceiling can also be an asset to the pilot if he is operating in an area where friendly forces have at best only air parity. A low ceiling forces enemy high performance tactical aircraft to work in or above the instrument meteorological conditions thereby reducing their ability to locate and attack low flying helicopters.

When combined with the need to conduct a critical mission, these assets may make it advantageous to conduct terrain flying in adverse weather. Visibility is the primary limiting factor which will determine whether the flight can be conducted successfully. With current equipment terrain flying is most difficult and extremely hazardous in dense ground fog, but certain missions can be accomplished in very low visibility conditions. If the mission requires flight from point A to B, it can be accomplished in very poor visibility by following linear features such as roads or rivers which are not exposed to enemy radar-directed air defense weapons. If by following a linear feature the aircraft remains unmasked long enough for the enemy to shoot at it, navigation must then be based on terrain orientation and greater visibility will be required to accomplish the flight. If the mission is a Cobra Tow attack, success will be influenced by visibility in the objective area as well as en route visibility.

In addition to normal planning, terrain flight in adverse weather imposes further planning requirements. A detailed map study of the route and the areas adjacent to it is essential. The aviator must identify every obstacle, hazard, road, trail, and prominent terrain feature which will influence his flight.

Since weather is often unpredictable, forecasts should be confirmed by troops in the area. When a multihelicopter operation is necessary, it may be desirable to send an aircraft into the area of operation to confirm the weather. The planning must also address mission termination criteria and inadvertent Instrument Meteorological Conditions (IMC) procedures.

During flight the most important considerations are to maintain visual reference with the ground and to maintain a slow enough airspeed to stop in time to avoid hitting an obstacle. Also, when flying along a road, altitude must be high enough to clear wires which even in only slightly limited visibility are almost impossible to see. If the crew suspects that they have strayed from the desired route, they should stop until their exact location is determined or return to the last known checkpoint and try again.

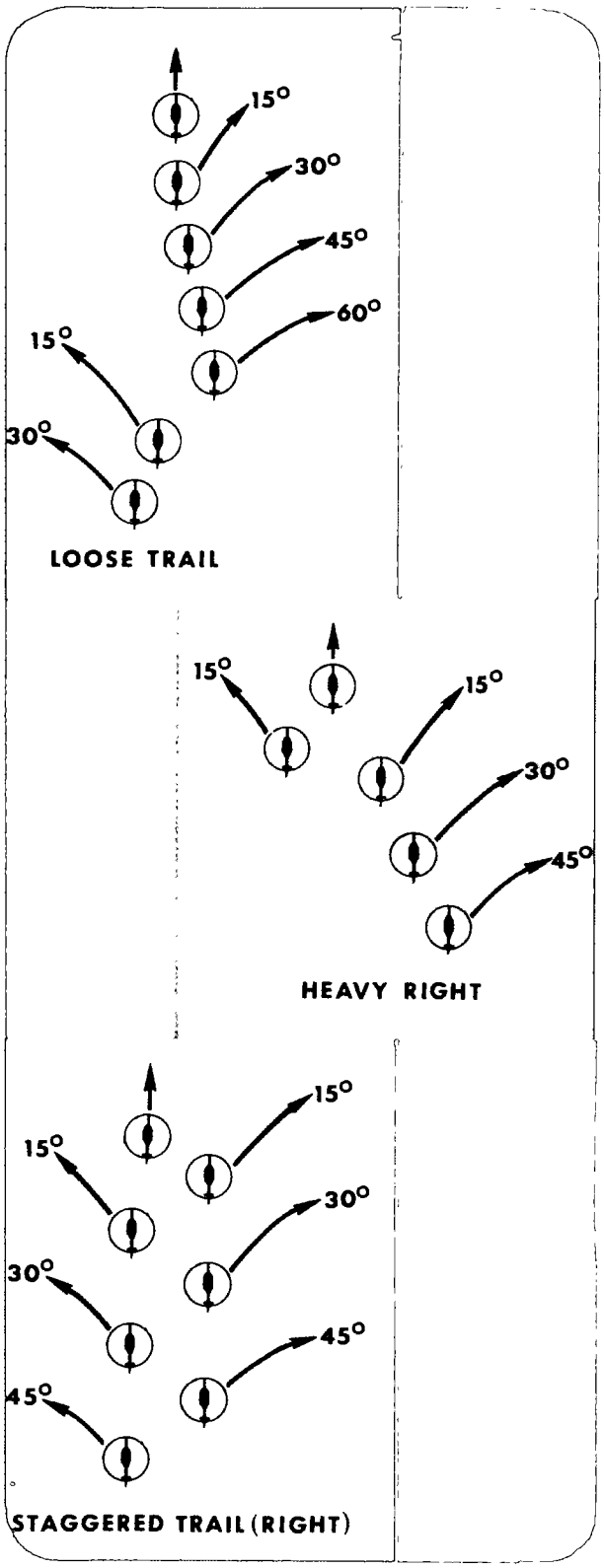
Terrain flying under adverse weather conditions sounds like a pretty stringent requirement, but a well trained crew exercising sound judgment and possessing an understanding of weather trends, can accomplish many missions.

Inadvertent IMC Procedures

The inadvertent IMC procedures discussed below are suitable if the aviator loses visual reference with the ground or visibility is too poor to locate obstacles and hazards. When the visibility conditions reach the point where the crew cannot navigate and the threat makes it impossible to climb to a high enough altitude to use tactical instrument flying, the best course of action may be to land prior to being forced to use the procedures discussed below. Visual reference with the ground can be lost on clear days as well as during adverse weather in dusty areas or areas of loose snow. Exercise extreme caution in such areas when hovering (even out of ground effect), and be sure to provide for adequate separation.

Maintaining visual reference with the ground is essential when terrain flying in adverse weather.

If visual reference with the ground (in weather) is lost, the most appropriate procedure for a single aircraft over level terrain might be to establish a climb and execute a 180° turn. This presumes the aircraft will not climb into the "kill zone" of enemy air defense weapons and that the terrain along the turn radius is free of obstacles. When the aviator is unsure of the



conditions to his left or right or cannot return to Visual Meteorological Conditions (VMC) using a 180° turn due to terrain or obstructions, he should begin an immediate climb to an altitude at least 100 feet above the highest obstacle within 2,000 meters of either side of the course. Upon reaching a safe altitude, he should initiate a 180° turn and return to VMC or initiate calls for appropriate assistance.

The inadvertent IMC procedures for multiple aircraft formations discussed in this paragraph may be appropriate if each aircraft is in the relative position depicted in figure 1-29. Upon entering IMC, an attempt to reverse course should not be executed until vertical separation has been achieved. With full consideration for terrain obstructions in the flightpath, the lead aircraft directs the formation to maintain altitude, airspeed, and heading. After a few seconds or immediately if the formation is tight or the terrain sharply diverse, the lead aircraft issues a command to execute the dispersion procedures. At this time, the lead aircraft begins a climb straight ahead. Each following aircraft turns in accordance with the SOP for the formation being flown. On initiating the turn, each aircraft increases power as necessary to establish a 500 fpm climb maintaining cruise speed. All aircraft in the formation proceed to a predetermined altitude for level off and monitor the lead aircraft calls for appropriate assistance.

In adverse weather conditions, flights should consist of as few aircraft as possible. When two or more flights are operating in an area simultaneously, separation must be insured by time and/or distance. If the flights are operating in close proximity and one reports entering IMC, the other flight or flights must remain under visual meteorological conditions, stopping if necessary.

Figure 1-29. Inadvertent instrument procedures.

1-8. HUMAN FACTORS IN TERRAIN FLYING

Because of the precision and concentration demanded to accomplish terrain flying, it is extremely fatiguing. Fatigue is a difficult problem to cope with because it cannot be measured and often goes unrecognized by the individual or his supervisor. It can only be averted by minimizing the physical, emotional, and self-imposed stresses that produce fatigue. A few of the common stresses are prolonged flight, temperature extremes (especially heat), colds, flicker vertigo, poor eating habits, overweight, alcohol and tobacco indulgence, and personal problems. Some of the ways to minimize fatigue in both training and combat environments include -

- Establishing flight time limitations and crew rest periods. Tests are being conducted to determine average terrain flight endurance limits; however, this will always vary from individual to individual. Therefore, it is important that the aviator recognize fatigue and be able to admit being too tired to function safely. In combat, 140 flight hours per 30-day period is considered the maximum that should be flown when flying at altitude. It is likely that these limits will have to be reduced in those units which habitually conduct terrain flying.

- Routine, supervised physical fitness training. Physically fit people have an increased ability to endure physical and mental stress, control emotions, relax, and sleep soundly.

- Training to develop and maintain proficiency. Teamwork can greatly reduce fatigue by division of duties and a reliance on the other individual. Teamwork and training repetitiveness until a task becomes second nature are additional keys to reducing fatigue.

The most common signs of fatigue are deterioration of aviator performance and judgment causing poor coordination, daydreaming, object fixation, and slowed reaction time.

Terrain and obstacle clearance is a critical task during terrain flight, especially NOE and contour flight. The pilot's peripheral vision is probably the key to terrain and obstacle clearance for the aircraft in daylight conditions. The use of peripheral vision is a process learned through experience by operating near obstacles. The pilot who is skilled at using his peripheral vision sees a large area to his side and rear without concentrating his vision in a particular area.

Also, the aviator must be aware of the size of the aircraft. He must "feel" the extent of the aircraft around him since he can't see it all. Where are the tips of the main and tail rotors? Where are the skids or wheels? Remember the terrain just negotiated when masking and unmasking - those tall trees must be cleared by the tail boom. Aircraft size appreciation and the development of the use of peripheral vision can be practiced on courses such as the preliminary training course discussed in appendix B. In very tight clearance situations, the pilot should use his crew to help insure clearances in those areas he cannot see well. If necessary, the pilot should have a crewmember dismount and ground guide the aircraft through or under an obstacle.

When terrain flying, the aviator relies heavily on his peripheral vision to insure obstacle clearance and for checkpoint identification.

Whereas obstacle clearance permits the mission to be conducted, mission accomplishment depends upon visual search. When terrain flying, visual search is required for navigation and target or objective acquisition. When navigating, visual search is the ability to promptly and effectively identify recognizable reference points (checkpoints) in your field of vision. Visual search is accomplished by both the central and peripheral fields of vision, but again the peripheral field of vision plays a decisive role. To conduct visual search, the individual must first have some concept of

what he will see. Checkpoints or targets must be thoroughly characterized before the mission. The aviator must have definite understanding of the effects of surrounding terrain, light and shadows, and seasonal changes on the appearance of the objective. A 4-hour change in time of day or a 10° change in direction of approach can dramatically and significantly alter visual expectation. Thus, the aviator especially must learn to *see* in his mind all the possibilities. Having this concept, his peripheral field of vision scans for forms that come close to the expectation for a given target or checkpoint. Each form is accepted or rejected peripherally and the central vision is used to identify the form when it matches his expectations. The probability of seeing and identifying the target will be determined by the size of the target and the distance of the observer.

The human factors just discussed - recognition of fatigue and its consequences, obstacle clearance factors, and visual search - significantly influence the ability of an aviator to perform terrain flight. Additional human factors relating specifically to night flight are discussed in TC 1-28, Rotary Wing Night Flight.

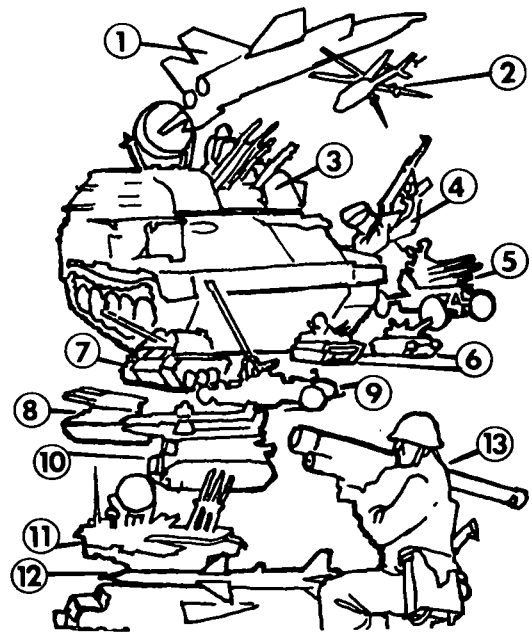
SUMMARY

The high threat environment is a potentially deadly environment built around an array of sophisticated weapons. These weapons pose a threat to us while we are in the air and while we are in fixed positions on the ground. To defeat the threat, certain tactics are required. These tactics include terrain flying, night operations, limited communication, tactical instrument flight, and frequent movement. Of these tactics, terrain flying is the fundamental element for mission success in the high threat environment.

To successfully perform terrain flight, the aviator must do more than simply reduce his altitude to suitable levels. He must solve the problems peculiar to terrain flight; he must plan his mission thoroughly; he must navigate accurately but, when necessary, be flexible; he must cope with man-made and natural hazards; and he must be mentally and physically fit. Flight planning involves not only the selection of routes, landing zones, and/or firing positions but also coordination, control, and possible suppression of enemy weapons.

Terrain flying is difficult even for experienced aviators and requires training and practice. Therefore, the remainder of this manual is devoted specifically to discussing terrain flight and related training.

The enemy air defense weapons depicted in figure 1-3 are identified in the following illustration.



1. MIG-25 FOXBAT
2. MIL 24 ATTACK HELICOPTER
3. ZSU 23-4
4. 7.62mm AKM ASSAULT RIFLE
5. ZPU-4
6. ZSU 23-4
7. ZSU-57-2
8. SA-6 GAINFUL
9. S-60 MILLIMETER GUN
10. SA-4 GANEF
11. ZSU-23-4 - GUNDISH RADAR
12. SA-3 GOA
13. SA-7 GRAIL

Bringing It Together

The following mission scenario is primarily intended to show how terrain flying is used in conjunction with other basic tactical concepts to accomplish a mission.

SITUATION: See figure 1-30, page 38. The Corps has been attacking to seize the city of LAGO which is a major communication and industrial center. The 7th Armored Division, which is the primary attacking force, has encountered heavy enemy resistance in the vicinity of the village of MOTSHA. The adjacent 93d Mechanized Infantry Division has successfully captured the high ground to the west of MOTSHA. The 1-29th Attack Helicopter Battalion (a Corps asset) has been attacking enemy armor in conjunction with the 7th Division attack. The 7-11th Air Cavalry Squadron has been screening the exposed right flank of the 93d Division.

MISSION: At 1510 hours, Army OV-1D reconnaissance aircraft report the movement on Highway 1 toward MOTSHA of a battalion size enemy armored force. The enemy armor was 33 miles north of MOTSHA moving at 20 mph. The 1-29th is assigned the mission of destroying the reinforcing armor before it reaches MOTSHA.

EVENT 1. MISSION PLANNING: In this scenario, planning was influenced by two considerations. First, was the saturation of the area by enemy air defense weapons with radar acquisition capability. Figure 1-31 depicts the area in which the enemy has radar acquisition capability. The second consideration was the urgency of the mission. In order to attack the enemy armor before it reached MOTSHA, the 1-29th had to be in its attack positions within a very short period of time.

Initially the area in which the enemy would be engaged was selected (fig 1-32, pg 39). Tentative attack positions were assigned to the two companies which would conduct the attack. Supplemental attack positions were also identified. Holding areas masked from enemy air defense weapons were selected. The 7-11th, which had been operating in the area, was assigned the mission of confirming the suitability of the attack positions and locating attack routes from the holding areas. Routes were also selected between the staging areas and holding areas. These routes were selected to minimize the flight time between the staging area and the holding areas. Artillery and TAC Air were requested to suppress known enemy air defense weapon locations. Friendly air defense artillery units were advised of the time and route of the unit's movement. Due to the minimal planning time and relative security of the routes to the holding areas, the same routes were used when exiting the area.

A key to successful execution of the mission is the mission briefing. It is important that each crew understand the mission and its duties. A thorough mission briefing will eliminate confusion and unnecessary radio communication. For this reason, even in this scenario where time was limited, all crews received a detailed mission briefing. Each crew also conducted a map reconnaissance to identify hazards along the routes to the holding area and to become familiar with the terrain between the holding area and attack positions.

EVENT 2. EXECUTION OF THE PLAN,

FOLLOWS ON PAGE 40.

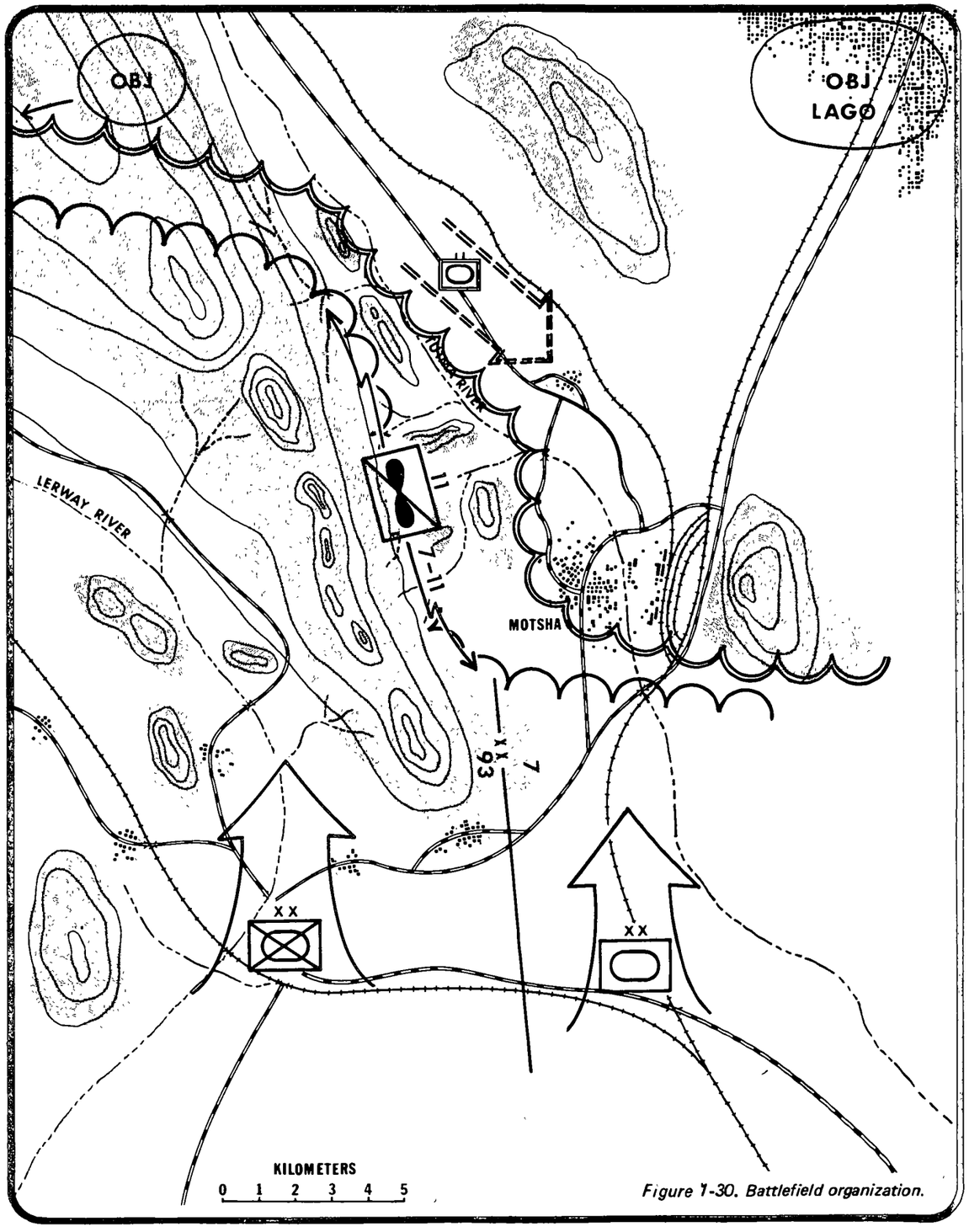


Figure 1-30. Battlefield organization.

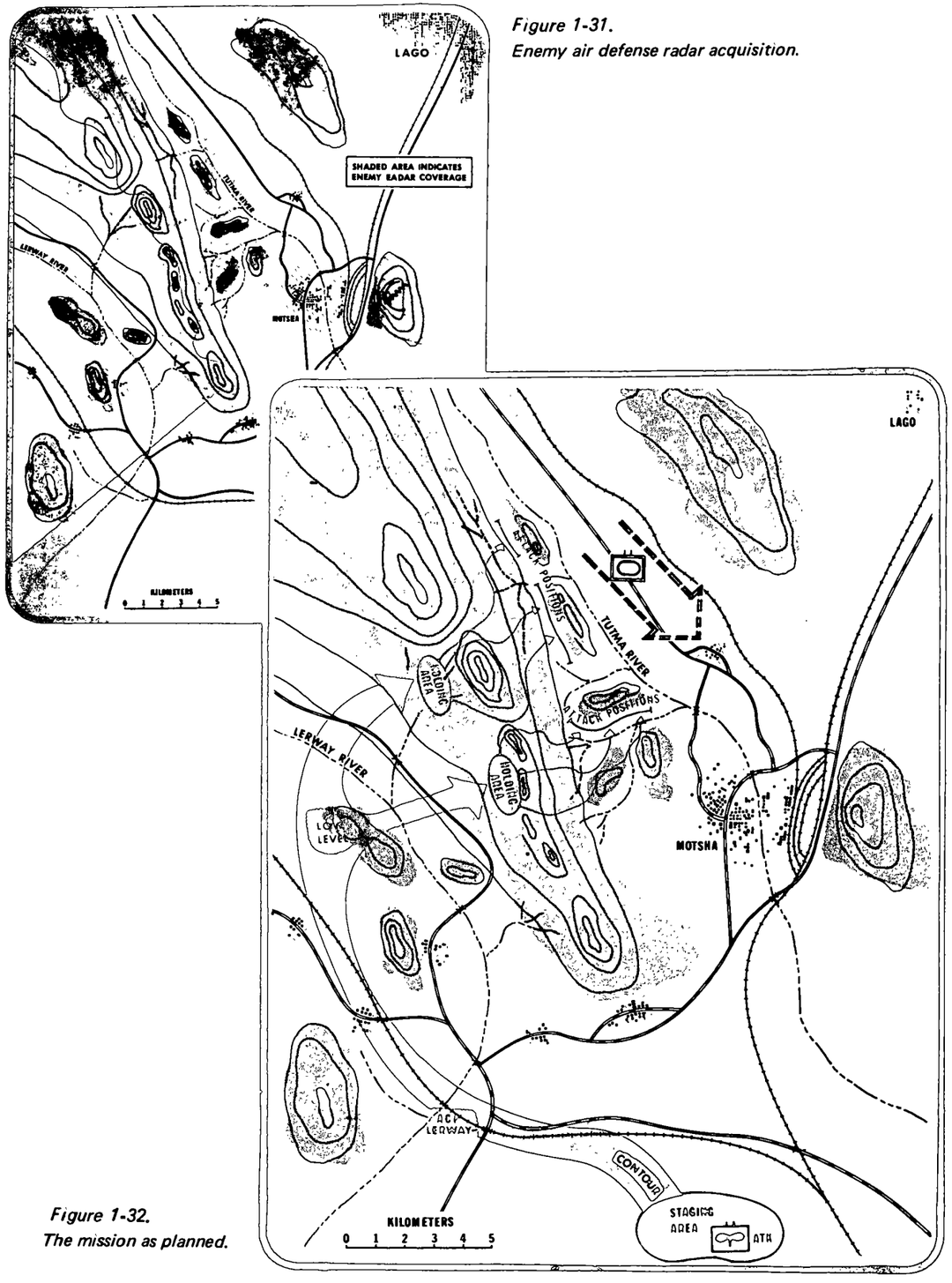


Figure 1-31.
Enemy air defense radar acquisition.

Figure 1-32.
The mission as planned.

EVENT 2. EXECUTION OF THE PLAN.

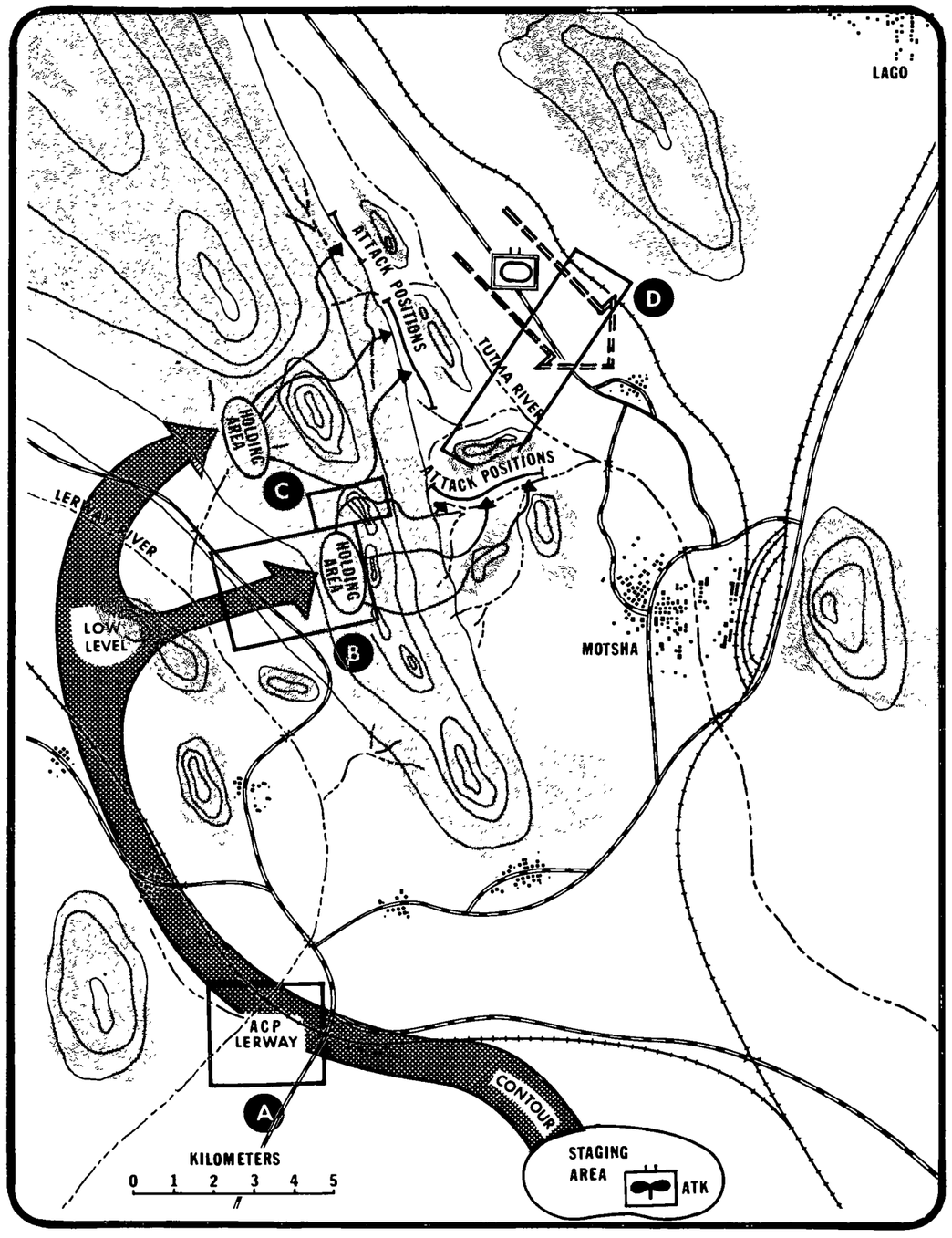
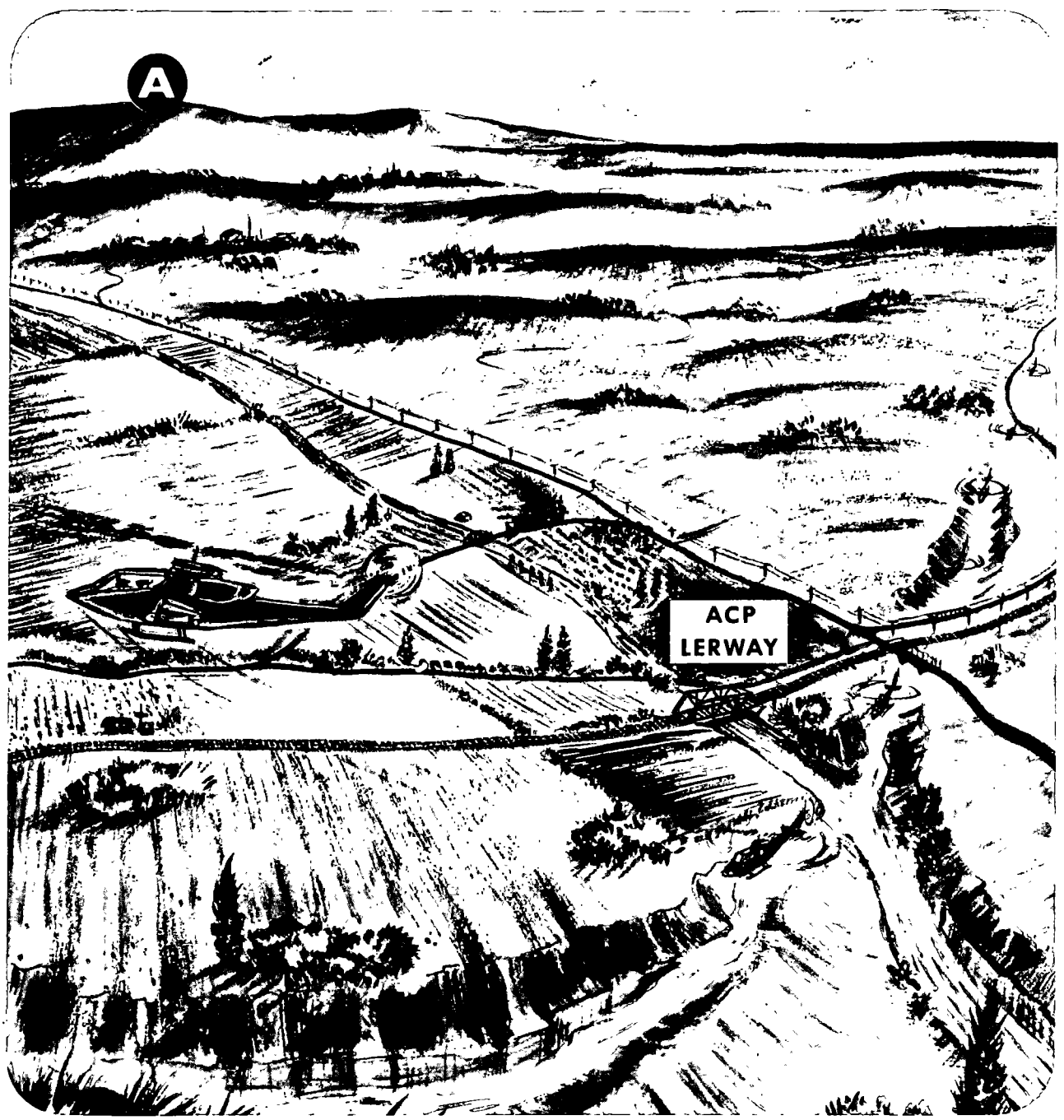
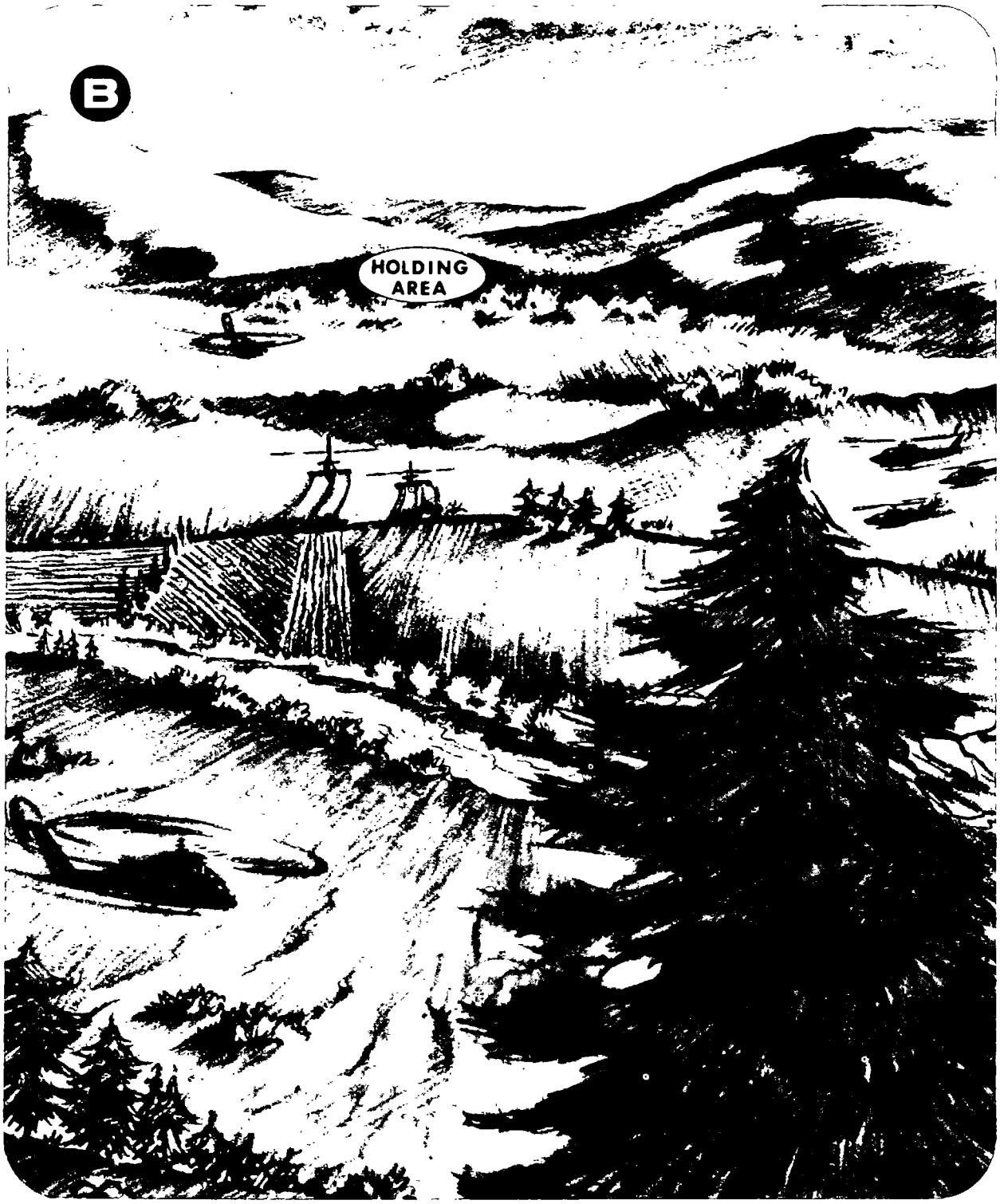


Figure 1-33. Execution of the plan.

FOLD OUT

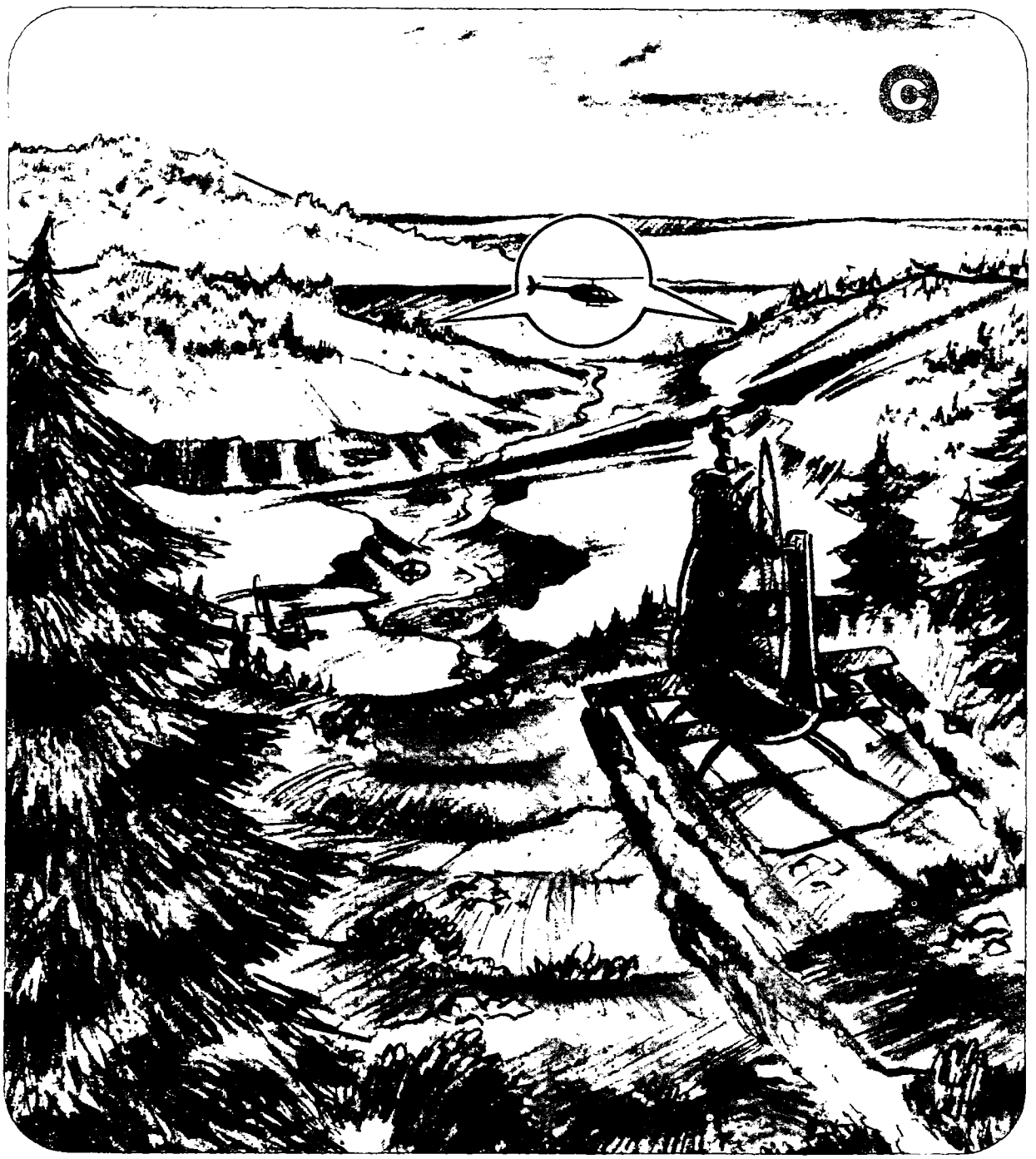
Since the terrain allowed the aircraft to remain masked, contour flight was used between the staging area and ACP LERWAY. Over most of this terrain the aircraft were able to fly up to 50 feet AGL and remain masked. However, when crossing the higher elevations the aircraft flew NOE below tree lines in order to insure that they remain masked. The contour routes were planned to follow streambeds since the ground is low and navigation is easier. At ACP LERWAY the flight climbed to low level altitude since the hill mass to the east provided terrain masking between 200 and 300 feet AGL. Between the staging area and holding areas contact with the enemy was not expected and the unit employed the traveling technique for movement.





Each company proceeded to its assigned holding area and held until artillery and TAC Air suppression of known enemy air defense positions began. This time was used to coordinate the attack by each of the various elements of the combined arms team. At the holding area the scouts who had been reconnoitering the area rendezvoused with the attack helicopters. They informed the 1-29th leaders of the location of the enemy armor, firing positions, and attack routes.

As the aircraft departed the holding areas, they crossed the ridgeline and became exposed to enemy air defense weapons. To minimize the loss of aircraft when exposed, several precautions were taken. First, the artillery and TAC Air were used to suppress the known air defense weapon locations. Secondly, the scouts led the Cobra's along the attack routes. Third, to reduce the effectiveness of antiaircraft fire from unknown enemy air defense weapon locations and from the ZSU 23-4's and SA-9's which may have been in the area as escorts for the armor, NOE flight was used. This allowed each aircraft to make maximum use of vegetation, draws, and other terrain features to remain masked. Even with these precautions, attack by the enemy was expected both when crossing the exposed ridgeline and when the Cobra TOW's exposed themselves to fire. Therefore, AH-1G Cobra's equipped with 2.75 HE and smoke rockets were assigned the task of providing overwatch for the AH-1Q Cobra TOW's.



The exact firing positions were selected to enable the AH-1Q's to fire the TOW's from maximum range. Positions for the overwatching elements were selected based on the range limitations of the rockets and to enable the crew to employ smoke rockets effectively against the optically guided SA-9's. When the enemy armor moved within range, the attacking helicopters unmasked and fired. Immediately upon missile impact the AH-1Q's remasked and moved on order to supplementary firing positions. Specific aircraft were assigned the task of attacking the ZSU 23-4's and other supporting air defense weapons. The scouts served as primary rescue aircraft for downed crews.

The attack was a success because the commander successfully massed the available firepower, enemy air defense weapons were attacked as priority targets, and the enemy was surprised.

CHAPTER 2

The Training Program

This chapter presents an overview of a training program which will prepare an aviation unit to conduct its missions utilizing terrain flight. Chapters 3 and 4 present the details of the suggested terrain flight training program which is organized in two phases - initial qualification training and advanced training, as shown in figure 2-1. In addition, this chapter discusses command responsibility, safety, control of training, selection and training of instructor pilots, and selection of training areas.

2-1. TERRAIN FLIGHT TRAINING PROGRAM ORGANIZATION

The nature of the high threat environment in which Army aviation must operate has become increasingly clear since the 1973 Middle East War. Training requirements to prepare the aviator to operate in the high threat environment are equally clear. Therefore, no commander should hesitate to conduct individual and unit training. "We should not spend the bravery of our people to make up for our lack of preparation." This comment from a senior Army commander is especially applicable to aviation unit training today.

Certain fundamental training requirements must be satisfied if an aviator and unit are to be able to perform terrain flying in the high threat environment. These training requirements are (1) a need for each aviator to be aware of the high threat environment; (2) day low level, contour, and nap-of-the-earth flight; (3) night low level and contour flight; (4) night NOE flight with night vision devices; and (5) execution of team, section, platoon, and company missions when terrain flying. The training program which this chapter introduces is specifically organized to satisfy these training requirements. While it may have to be modified based on local conditions, the goal of each tactical unit's training program must be to attain a true night fighting capability.

The first of the two training phases - initial qualification training - is designed to familiarize the aviator with aviation

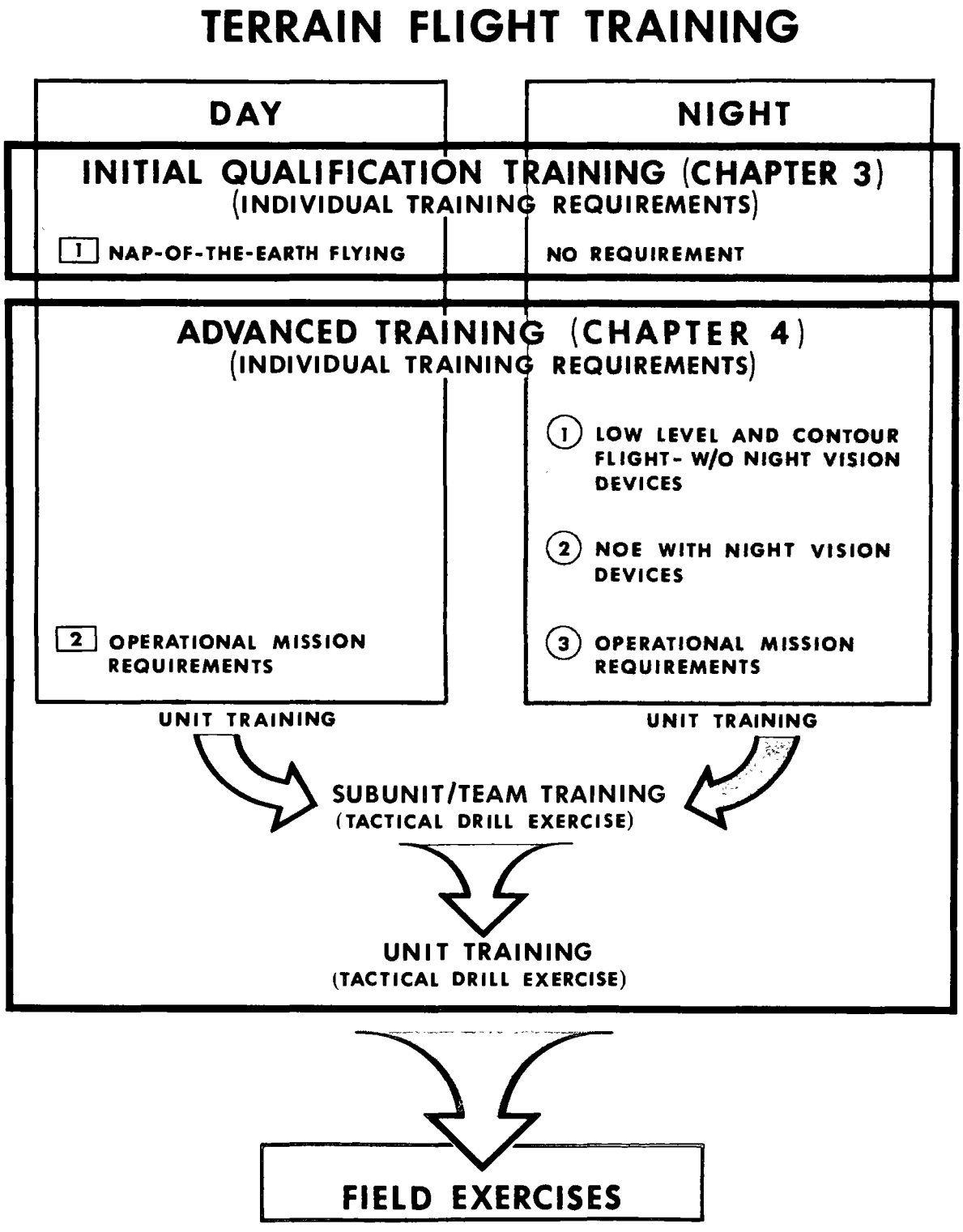


Figure 2-1. The training program.

operations in the high threat environment and teach him the navigation and flight skills he needs to conduct terrain flight. Upon completion of initial qualification training, the aviator is ready to participate in advanced training. Advanced training is designed to train the individual to accomplish the unit mission in the high threat environment utilizing terrain flight during both daylight and darkness. It will include employment of aircraft, planning and coordination between ground and aviation units, explains teamwork required between aircraft, and will be tactically realistic. Once the unit proficiency has reached a suitable level, it should operate in a simulated high threat environment to the maximum extent possible to maintain individual and unit proficiency.

The need to maintain individual aviator proficiency in low level, contour, and NOE flight is as critical a training requirement as is qualification. In those units which normally conduct terrain flying, maintaining individual proficiency will be achieved along with maintaining unit proficiency; however, there are numerous aviators who do not frequently conduct terrain flying. To assist commanders in developing a training program to maintain the proficiency of these aviators, a terrain flying confidence course is outlined in chapter 5.

COMMAND RESPONSIBILITY

For effective accomplishment of initial and advanced training, commanders should plan and supervise training to insure -

- Training develops aviator proficiency to operate aircraft at all altitudes associated with terrain flying and in all conditions necessary to accomplish the unit mission. Also, the training must prepare him to meet the range of in-flight emergencies that can occur close to the surface.
- Training is standardized.
- Aviators are given adequate opportunities to maintain the knowledge and skill required to conduct terrain flying.
- Establishment of criteria to help prevent operational skill fatigue (para 1-8). If for any reason, an aviator's ability to conduct terrain flying is impaired or subject to doubt, the commander should prohibit that individual from participating in training or operations until the circumstances causing that condition have been corrected.
- That terrain flying, whether it be training or mission, is as closely supervised as conditions permit.
- That unit training programs are conducted under simulated conditions of the high threat environment. Because aviation units often conduct training in conjunction with training exercises of ground units, one of the primary requirements for the aviation unit commanders must be to insure that the ground commanders are aware of the training requirements of the unit and that the training is conducted in a simulated high threat environment. It is the aviation unit commander's responsibility to insure that his aircraft are employed in training as they would be in the high threat environment.

2-2. SELECTION AND TRAINING OF INSTRUCTOR PILOTS

If there is a single most important ingredient for aviation training success, it is the instructor pilot (IP). The instructor pilot is primarily concerned with teaching survival and success on the battlefield, but he must also teach flight maneuvers and emergency procedures. When selecting an instructor pilot, his skill is the critical consideration, but his desire to instruct directly influences the quality of training. Other considerations include his appreciation and understanding of the ground maneuver force, aviation tactical concepts, and the operational requirements and limitations in the high threat environment.

SKILL AND DESIRE ARE THE IMPORTANT CONSIDERATIONS WHEN SELECTING AN INSTRUCTOR PILOT.

Instructor pilots and standardization instructor pilots (SIPs) will be appointed in accordance with chapter 1, AR 95-63. In addition to the requirements outlined in AR 95-63, before conducting terrain flight training, the IP and SIP must have completed a terrain flight training course; demonstrated to an SIP his ability to instruct in the various modes of flight; and be a currently rated rotary wing IP in the type and model aircraft in which flight maneuvers will be accomplished.

Each instructor pilot must be given thorough instruction on the flight techniques, methods of instruction (MOI), and hazards of terrain flight training. He should receive a minimum of 15 hours flying the aircraft and 15 hours navigating prior to instructing. In addition to learning what is to be taught and how to teach it, the IP must become familiar with the training area so that he can determine his location at all times without having to divert his attention to a map.

When the instructor pilot is teaching terrain flight, he has three primary training responsibilities. He must teach the aviator the techniques of handling the aircraft with skill and finesse. He also teaches navigation and related map reading and planning skills. The third primary training responsibility of the instructor pilot is crew integration and teamwork which ties together the other two. Also, during initial qualification training the instructor pilot will be teaching or supervising academic instruction. During advanced training he will be an important part of the training process insuring standardization and proficiency.

PRIOR TO TEACHING TERRAIN FLIGHT, THE INSTRUCTOR PILOT SHOULD BE THOROUGHLY FAMILIAR WITH THE TRAINING AREA.

The commander is the final authority on the capability of his unit to perform properly on the high threat battlefield. This authority and responsibility cannot be delegated. Rather it must be exercised by personal participation in training and in close monitorship of unit IPs, SIPs, and progress of individual helicopter crewmembers.

INSTRUCTOR PILOTS MUST DEMONSTRATE THEIR COMPETENCE AS AN INTEGRAL PART OF THEIR QUALIFICATION TO INSTRUCT.

2-3. TRAINING SAFETY

Commanders may feel that individual and unit terrain flying programs will introduce unacceptable training risks and therefore jeopardize mission accomplishment. It is possible that some aircraft may be lost in training, but the magnitude of the threat dictates that training be conducted now, prior to an outbreak of hostilities. It can be done without neglecting the controls and safeguards needed to help prevent accidents. To help minimize the safety risks, commanders and leaders must strictly supervise and control the training to insure no independent experimentation is conducted. Unwavering adherence to flight standardization procedures is also essential to reduce training risks.

The risks associated with terrain flying can be minimized with adequate supervision, control, and adherence to flight standardization procedures.

Control of Training

Control is essential to insure safe training but the commander must establish the proper balance between control, training realism, and supporting resources. The techniques suggested below provide a balance of control and tactical realism but require a relatively high amount of supporting resources. These techniques are suggestions and should be modified as required based on the local situation, degree of aviation proficiency, and available resources.

During *initial qualification training* and the *individual night training* phases of advanced training, a commander should operate a centralized control system. To do this the following techniques should be used:

- Safety and control (S&C) aircraft should be used when several aircraft are training simultaneously to control training areas, insure traffic separation, create tactical situations, and provide rapid response in emergencies. The S&C aircraft should operate at an altitude so as not to interfere with the training aircraft. If the commander chooses not to employ an S&C aircraft, he should develop a "buddy system" to be used between training aircraft to help insure separation and provide rapid response.

■ Air control points (ACP), boundaries, and air (flight) corridors can be used effectively to control aircraft in training as well as during tactical missions.

■ Position reports should be used to maintain the location of each aircraft when numerous aircraft are training simultaneously. In addition to position reports being made at appropriate ACP's they should be made any time the aircraft leaves the planned route.

■ A radio search should be conducted if a training aircraft has not reported to the S&C or his buddy aircraft within the preceding 15 minutes. To eliminate unnecessary air searches in the event a training aircraft experiences "lost commo," a lost commo rendezvous point should be identified in the training area. After experiencing lost commo the training aircraft would proceed to the rendezvous point. Upon completing its radio search the S&C aircraft would check the rendezvous point.

During the *unit training* phases of advanced training, the commander should decentralize control to realistically reflect operational control procedures which would be used during combat. He should rely heavily on his subordinate leaders to provide the necessary control. He should closely monitor planning to insure that adequate control is planned by subordinate leaders and that training is realistic.

Safety and Control Helicopter Pilot Responsibilities

When the S&C aircraft is used, the pilot's duties should include those discussed below. The crew will assist the S&C pilot as he directs.

■ He will receive a briefing from the training officer on the contents of the S&C pilot's SOP and the specific duties of the S&C aircraft crew. He should be familiar with the training and safety SOP's.

■ He monitors the preflight briefing of aviators and conducts preflight preparations. He must be familiar with the weather to include the density altitude; ceiling; visibility; and wind velocity, direction, and gust spread. He must prepare a flight-following map and conduct a hazards map check. The flight-following map should depict all routes (corridors), air control points, landing zones, restricted areas, and hazards. Used in conjunction with the flight-following map is the flight-following log. This locally prepared form is used to log position reports from numerous aircraft operating simultaneously. The sequence block is used if two or more aircraft

During training, when feasible, safety and control (S&C) aircraft should be used to control the aircraft which are terrain flying.

share a route and are separated by a constant time interval (requires one form per aircraft).

■ During training he maintains the flight-following log and should have available the flight-following map, reporting requirements, operation orders for each route, and the training communications - electronics operating instructions (CEOI). He must remain in radio contact with each aircraft. If more than 15 minutes have elapsed since the last call from an aircraft, the S&C pilot will initiate a radio search. Also, he reports any unanticipated hazards (i.e., stray aircraft and inclement weather) to the training aircraft. He issues and/or answers tactical calls while acting as the combined arms team's higher and adjacent headquarters (knowledge of the tactical mission and situation for each aircraft is a must).

■ A critical responsibility of the S&C pilot is to control the entry of observer aircraft into the training area. There will be a tendency for many people to want to observe individual and advanced training because terrain flying is a high interest item in the Army today. Uncontrolled, this can lead to serious problems, and there have been near-misses as a result of observer aircraft becoming intermingled with training aircraft.

■ He remains on station until all training aircraft have departed or designates another (training) aircraft as an alternate S&C if he must leave station.

■ Each S&C helicopter should have, in addition to its required crew, one medic and two rappel-qualified personnel with appropriate equipment if an air ambulance is not available. The medic should also be rappel qualified and have adequate first aid equipment.

FLIGHT-FOLLOWING LOG

ROUTE 1		ROUTE 2		ROUTE 3		ROUTE 4	
ACFT NO 0187	CALL SIGN BULDOG 15	ACFT NO	CALL SIGN	ACFT NO	CALL SIGN	ACFT NO	CALL SIGN
IP WEAVER	SEQUENCE	IP	SEQUENCE	IP	SEQUENCE	IP	SEQUENCE
STUDENT SMITH	STUDENT JOSSEN	STUDENT	STUDENT	STUDENT	STUDENT	STUDENT	STUDENT
POSITION SP	TIME 1038	POSITION	TIME	POSITION	TIME	POSITION	TIME
ACP RED	1101						
ACP BLUE	1114						
LZ	1126/1130						
ACP GREEN	1144						
ACP ORANGE	1158						
RP	1211						

Hazards Identification Map

One of the most important aids in helping to insure safety is the hazards map. A hazards map will be maintained depicting hazards and restrictions within the unit's training areas. The map must be updated after any flight when an unplotted hazard is located. Prior to conducting training, hazards will be marked on maps used in the aircraft by aviators and instructor pilots.

Crossing Wires

To conduct realistic terrain flight training, it is necessary to fly under wires if the simulated enemy threat demands it and if adequate clearance exists. However, during training, flight under wires must be stringently controlled to prevent accidents from occurring. Therefore, wires should be underflown only at points where clearance has been predetermined to be sufficient. Wire obstacles built as training aids should utilize low tensile strength wire and have a break-away capability. Thin wires can be made more visible by wrapping the wire in masking tape.

2-4. TRAINING AREAS

Prior to conducting training, permission to use property not within the confines of a military reservation for landing zones must be secured from property owners. This may be accomplished through coordination with the local installation engineer element which will obtain assistance through the district engineer headquarters. Because the noise associated with training at the low altitudes utilized during terrain flying can be irritating, every effort should be made to familiarize people in affected areas with the need for the training. Good public relations are absolutely essential. Specific considerations relating to the training areas for initial qualification training are discussed in chapter 3. Those considerations relating to advanced training are discussed in chapter 4.

TRAINING AREA CONSIDERATIONS

- The initial qualification training areas should be selected to develop the ability of the aviator/crewmember to navigate NOE as well as familiarizing him with the tactical applications of terrain flying.
- For advanced training, the training area must be selected to provide a realistic training environment based on unit mission.
- Army Regulations and Federal Aviation Regulations pertaining to controlled airspace can induce additional restrictions or restrict training areas.
- A critical task associated with terrain flying is the continuing evaluation of the aircraft location and its relationship to enemy air defense weapons and intermittent terrain. Therefore, the training area should offer a wide range of terrain relief in order to train the aviator to evaluate his altitude options during planning and flight.
- The training area should have as few hazards and obstacles as possible.
- The training area should be selected to avoid population concentrations.
- The training area should also provide suitable space for performing all out-of-ground-effect hover checks required prior to conducting NOE flight and to conduct instruction in NOE flight maneuvers.
- Training areas should include alternate landing zones to be used for preplanned or on-order missions. Landing zones should be free of crops and sod based.

SUMMARY

This chapter has served as an introduction to the terrain flight training program. The program consists of two phases - initial qualification training and advanced training - which satisfy the fundamental training requirements to prepare an individual and unit to conduct missions in the high threat environment using terrain flight.

This chapter also discussed four topics applicable to both initial and advanced training. The first of these was command responsibility. The second was safety which includes control of training. Several techniques to aid in controlling training were discussed. The third concerned the selection and training of instructor pilots. The fourth topic was the selection of training areas. Only general considerations were discussed under this final topic heading. Specific considerations relating to training areas for initial and advanced training are discussed in chapters 3 and 4, respectively.

CHAPTER 3

Initial Qualification Training

This chapter describes initial qualification training objectives, provides a suggested program of instruction, outlines techniques of instruction, and includes flight period outlines that will prepare the aviator to conduct terrain flight and begin participating in advanced training.

3-1. INTRODUCTION

To perform terrain flying the aviator must be able to conduct low level, contour, and NOE flight. Army aviators are familiarized with low level and contour flight during training in flight school and most have been further trained in units. Therefore, it is not generally necessary to retrain an aviator in these flight techniques. However, many aviators are not prepared to operate utilizing NOE techniques since they have not received the additional training required. This additional training is required because of the increased navigation difficulties at NOE altitudes, flight maneuvers peculiar to NOE, and emergency procedures more critical during NOE flight. Aviators graduating from flight school since 24 September 1974 have received the additional training required to conduct NOE flight. It is a unit training requirement to train the aviators who graduated prior to this date.

The initial qualification training course is designed to familiarize the aviator with the high threat environment and the employment of Army aircraft in that environment, to refresh the pilot's skill in low level and contour flight, and to qualify the aviator in nap-of-the-earth (NOE) flight. After completing the initial training course, the aviator will possess the basic individual knowledge and skills required to operate on the modern battlefield. Advanced training will refine these skills and apply them to unit operations for both day and night flying.

INITIAL QUALIFICATION TRAINING OBJECTIVES

Flight Training

Aircraft Handling	■ Performance of the tasks required to conduct NOE flight to include flight maneuvers and emergency procedures. Satisfying this training objective also involves teaching the aviator how to move; clearance judgment; aircraft size appreciation; and how to use the shadows, sun, and reduced visibility to his advantage. The skill of the aviator to conduct low level and contour flight must also be evaluated and any required refresher training provided.
Navigation	■ Performance of the tasks required to conduct en route NOE navigation in order to find the objective 100 percent of the time. As a minimum standard, the aviator should navigate to an accuracy of 100 meters. Evaluate aviator skill to perform low level and contour navigation in order to find his objective 100 percent of the time.
Crew Integration	■ Performance of the tasks required to operate efficiently in the cockpit. To teach the crew to effectively communicate is the most important aspect of this objective. This requires the development of communication techniques and standardized phraseology. These tasks also include development of teamwork; division of duties; and proper radio usage, discipline, and security.

Academic Training

Threat and Tactics	■ Knowledge of the high threat environment. This instruction should include the capabilities and methods of employment of the air defense weapons, electronic warfare equipment, artillery, and aircraft of our potential enemies. Knowledge of tactics necessary to reduce the effectiveness of the threat.
Human Factors	■ Knowledge of human factors in terrain flying such as flying fatigue and perception of the external environment, and their impact on mission accomplishment.
Navigation	■ Knowledge of map and aerial photo study techniques necessary for visual pilotage. Navigation techniques for NOE flight should also be explained and navigation techniques for contour and low level flight reviewed.
Mission Planning	■ This includes the selection of masked routes, landing zones, and firing positions; determination of maximum altitudes; knowledge of the principles of "analysis of the area of operation" (thorough and systematic study of a combat area of operations); and planning the use of suppressive fires, smoke, and counter radar measures.

INITIAL QUALIFICATION TRAINING

A program of instruction similar to the one suggested below will prepare the aviator to conduct terrain flight and to begin participating in advanced training.

SUBJECT BLOCK	HOURS
Academic Training	
I. Introduction and Safety	1.5
II. Human Factors Impacting on Terrain Flying	2.0
III. Terrain Flying Operational Considerations	3.0
IV. Map Reading	12.0
Map and Aerial Photo Study and Interpretation (10.0)	
Navigation (2.0)	
Terrain Walk (as required)	
V. The High Threat Environment	7.5
Introduction (0.5)	
Threat (3.0)	
Employment of Army Aviation in the High Threat Environment (4.0)	
VI. Tactical Mission Planning	8.0
Utilization of Combat Intelligence (1.0)	
Employment of Artillery, Radar Jammers, Chaff, and Smoke for Suppression of Enemy Air Defense Weapons (2.0)	
Coordination with Friendly Air Defense Units, Ground Forces, and Air Force Tactical Aircraft (2.0)	
Practical Exercise (3.0)	
Total	34.0
Flight Training	
Introductory Briefing	1.0
NOE Flight Training	21.0
Total	22.0
Course Total	56.0 hours

3-2. ACADEMIC TRAINING

The academic instruction presented during the initial qualification training should be based on current unit training and aviation proficiency related to operating in the high threat environment. The academic training POI as suggested is divided into a series of blocks of instruction (I through VI), each of which is an essential subject area required to prepare an aviator to conduct terrain flight and operate in the high threat environment. The hours indicated are minimums. Under blocks IV, V, and VI, specific classes are identified as suggestions for presenting the required material. Each block/class identified in the POI is discussed. Additional blocks or classes may be required due to unit mission and unit training requirements identified by the commander. The suggested POI should be modified as necessary by the commander to meet his own unit training requirements.

SUBJECT	HOURS	CLASSIFICATION	TYPE R = Review C = Conference PE = Practical Exercise
INTRODUCTION AND SAFETY	1.5	U	1.5 C
Objective: The aviator will be able to define terrain flying and low level, contour, and nap-of-the-earth flight. He will know the hazards associated with terrain flying and proper procedures for avoiding these hazards. He will become familiar with the unit and training safety SOP, the hazards map, restricted areas in the training area, and cockpit teamwork as it relates to safety of flight.			
Training Aids: TF 46-4920, "Down to Earth - NOE," 45 minutes.			
References: AR 95-1, appropriate operator's manuals, and unit safety and training SOP.			
HUMAN FACTORS IMPACTING ON TERRAIN FLYING	2.0	U	2.0 C
Objective: The aviator will be able to recognize operational skill fatigue - its occurrence, recognition, and treatment. He will be familiar with human factors as they relate to visual scanning, acquisition techniques, cockpit teamwork, and crew selection. *Note: The flight surgeon should either give the class or be consulted to provide input for the development of this class.*			
References: AR 95-1 and TC 1-20.			
TERRAIN FLYING OPERATIONAL CONSIDERATIONS	3.0	U	2.0 C 1.0 PE
Objective: The aviator will become familiar with cockpit teamwork to include division of duties and crew procedures. He will be able to discuss the advantages and disadvantages of each of the flight levels associated with terrain flying. He will know the emergency procedures critical in NOE, contour, and low level flight and how to accomplish those procedures. He will estimate accurately at least 40 examples of vertical and lateral clearance (PE).			
References: Appropriate flight standardization guides and maneuver guides, appropriate operator's manuals, and AR 95-1.			

SUBJECT	HOURS	CLASSIFICATION	TYPE

MAP READING

MAP AND AERIAL PHOTO STUDY AND INTERPRETATION	10.0	U	2.0 R 3.5 C 4.5 PE

Objective: The aviator should master a comprehensive map reading review which emphasizes identification of terrain features necessary for visual pilotage. The training should not deal with identifying legend symbols, coordinate reading, and other similar aspects of map use the aviator should already know. He will learn the techniques and goals of detailed map study, placing special emphasis on his being able to identify useful checkpoints. This training should teach the aviator to predict, on the basis of map study, which portrayed features will be visible when flying a route. Equally important, he must learn to predict, by studying the map, those areas masked from enemy detection. He will be able to utilize aerial photographs to insure map accuracy and as a map substitute. He should be able to perform a practical exercise using slides or films taken multidirectionally (at varying altitudes and ranges) of key terrain to determine his location. He will demonstrate knowledge of the requirements and considerations relating to selection of routes, landing zone, and firing positions. He will be able to determine maximum altitudes at which he could fly and still avoid detection. He will be familiar with the techniques of preparing a map for NOE navigation to include map orientation and marking. He should be able to construct terrain profile diagrams between his route and known enemy locations.

Training Aids: An instructional packet of map interpretation training materials is currently under evaluation at Fort Rucker. The packet will be available for distribution upon successful completion of the evaluation. The packet will contain an instructional text with slides, cassettes, and films of NOE flight designed to accelerate the development of map interpretation skills used in actual terrain flying.

References: FM 21-26, AVN Subcourse 75 Map Reading and **FM 1-5 To be published.**

NAVIGATION	2.0	U	2.0 C

Objective: The aviator will know the difference between the techniques used for navigation during NOE, contour, and low level flight. He will be able to utilize the communication techniques between pilot and copilot/observer required for NOE navigation. He will be familiar with the effects of weather, season changes, and light changes on NOE navigation. He will be able to discuss differences in navigation techniques based on differences in types of terrain (flat, desert, wooded, rolling, and mountainous). He will be able to describe a course from a map as he would do when flying.

References: FM 21-26 and FM 1-5.

SUBJECT	HOURS	CLASSIFICATION	TYPE
TERRAIN WALK	As Required	U	-

Objective: The aviator will, by means of a terrain walk, be able to visually interpret contour lines from a map and know how they appear as land forms. The aviator will be able to identify all major terrain features.

THE HIGH THREAT ENVIRONMENT

INTRODUCTION	0.5	U	0.5 C

Objective: The aviator will learn what constitutes a high threat environment. He will be able to discuss the restrictions that the high threat environment imposes on Army aviation.

Reference: **FM 90-1 To be published.**

THREAT	3.0	C	3.0 C

Objective: The aviator will learn threat antiaircraft weapons with emphasis on those systems likely to be encountered on the forward edge of the battle area; enemy threat doctrine regarding air defense weapon deployment in the attack and defense; and probable kill and hit factors for each weapon system (single burst at various ranges). He must learn the capabilities and limitations of each system. He will be familiar with the use of electronic warfare in the high threat environment. He will know the threat presented by high performance aircraft and attack helicopters. He should be able to identify (from photographs) enemy threat weapons and equipment. He should know the range and firing characteristics of enemy artillery weapons. *Note: G2/S2 personnel should be consulted to provide current and specific threat data.*

References: FM's 30-5 and 90-1.

EMPLOYMENT OF ARMY AVIATION IN THE HIGH THREAT ENVIRONMENT	4.0	U	4.0 C

Objective: The aviator will learn techniques for employing utility, attack, reconnaissance, and cargo helicopters. He should be able to relate each type aircraft to its function as an augmentation of the ground forces in each separate type operation. He should be familiar with the employment of each type aviation unit in both offensive and defensive type operations. He should be able to discuss air-to-air tactics for Army helicopters. He should understand control and signaling procedures as well as what constitutes flight or firing restrictions. He must know the procedures for operating in an electronic warfare environment. He should understand the use of darkness and inclement weather as a means of enhancing the survivability of Army aircraft in the high threat environment.

References: FM's 1-40, 6-102, 17-1, 17-30, 17-36, 17-37, 61-100, 90-1, 100-5, and 100-26; **TC 1-28 To be published.**

SUBJECT	HOURS	CLASSIFICATION	TYPE

TACTICAL MISSION PLANNING

UTILIZATION OF COMBAT INTELLIGENCE	1.0	U	1.0 C

Objective: The aviator will be able to discuss the intelligence requirements for aviation operations in the high threat environment. He will understand the utilization of intelligence data in tactical mission planning. He will be familiar with the sources of both military and civilian intelligence.

References: FM's 30-5, 30-10, 90-1, and 101-5.

EMPLOYMENT OF ARTILLERY, RADAR JAMMERS, CHAFF, AND SMOKE FOR SUPPRESSION OF ENEMY AIR DEFENSE WEAPONS	2.0	C	2.0 C

Objective: The aviator will be able to discuss the ways in which chaff, smoke, and radar jammers can be used to reduce the effectiveness of enemy air defense weapons. He will understand the use of preplanned artillery fires for suppression. He will be able to plan the employment of suppressive fires. He will know the techniques for adjusting field artillery.

References: FM's 6-20, 90-1; and **TC 6-40-4 To be published.**

COORDINATION WITH FRIENDLY AIR DEFENSE UNITS, GROUND FORCES, AND AIR FORCE TACTICAL AIRCRAFT	2.0	U	2.0 C

Objective: The aviator will be able to discuss airspace management in the high threat environment as it relates to his ability to move about the battlefield. He must understand coordination requirements between ground units (especially air defense units) and aircraft. He must understand air defense unit identification criteria. He will be able to discuss the employment of Air Force high performance aircraft for air defense suppression and in coordinated attacks with Army aircraft. He will understand the control procedures required in such operations and the methods of requesting such Air Force support.

Reference: FM 90-1.

PRACTICAL EXERCISE	3.0	U	3.0 PE

Objective: The aviator will plan a tactical mission (suggestion: a raid type insertion along the FEBA requiring that it be accomplished under conditions of radio silence). He will demonstrate his knowledge of map study and tactical considerations in selecting his routes and landing zones. He will be able to use aerial photos to confirm map data. He will identify likely ambush positions along the route. He will show sound tactical judgment in the employment of his helicopter and supporting attack and/or reconnaissance aircraft. He will properly plan the use of suppressive fires. He will be able to discuss the coordination requirements with friendly ground forces (especially friendly air defense units).

3-3. FLIGHT TRAINING

Initial qualification flight training is primarily intended to teach NOE flight maneuvers and navigation. Low level and contour flight and navigation skill should be evaluated by using low level and contour flight to and from the training areas. As the aviator develops his NOE flight expertise he should find it easier to conduct low level and contour flight. However, if additional training in low level or contour flight/navigation is needed, the IP should request additional flight time for the needed training.

All flight training will be conducted in a simulated high threat environment. The aviator must assume that he can be detected either visually, optically, or electronically whenever he fails to properly utilize the terrain to mask his movement/location. Especially in the latter stages of training, the instructor pilot must emphasize this. The aviator must properly utilize the terrain to mask his movement and must not expose himself to known or suspected enemy air defense positions for more than 10 seconds.

Prior to conducting flight training, the commander should conduct a briefing outlining the need for the training and its objectives. He should also discuss the control and conduct of the training, identify local restricted areas, and discuss safety.

For several reasons the UH-1 is the most suitable aircraft for conducting initial qualification training. The pilot and instructor pilot sit in the crew seats and the crewmember who is navigating sits in the jump seat centered between the pilot and instructor pilot. This allows one aviator to fly a route while the other navigates. Conducting training in this manner provides each aviator 15 hours for piloting the aircraft in addition to the 6 hours allocated for NOE flight maneuver training. This is important because it helps develop the aviator's obstacle clearance judgment. The disadvantage of using an observation helicopter for this training is that forward visibility is restricted from the rear seat, thereby making navigation from the rear seat almost impossible. For effective training in observation or attack helicopters, the instructor pilot will be able to train only one aviator at a time. In this case the aviator does not receive the pilot time necessary to help develop obstacle clearance judgment unless additional hours are added to the POI. Also, when the instructor pilot conducts training on a one-to-one basis, he must either navigate or fly - thereby diverting his attention from his primary mission of training.

The flight training consists of 10 flight periods and an evaluation ride and is conducted in two phases as discussed in the following subparagraphs:

■ Phase I - Preliminary Training and Navigation. This phase includes a review of pertinent contact and tactical flight maneuvers, a demonstration of NOE, introduction to and practice

of NOE peculiar flight maneuvers, and aviator practice in flying and navigating preplanned NOE flight routes. A useful tool for teaching NOE flight maneuvers is the preliminary training course discussed in appendix B. This phase will normally consist of flight periods (FP) 1 through 4. It is designed to instill in the aviator confidence and understanding of the NOE flight environment and to train him to navigate to the required accuracy of 100 meters. This training will emphasize checkpoint identification (map/terrain association). The instructor pilot analyzes the individual aviator's navigational ability, judgment, related skills, and knowledge to determine the pace and intensity of the training in Phase II. Proficiency in Phase I is a prerequisite to initiation of the second phase.

■ Phase II - Tactical Orientation. This phase is designed to develop the ability of the aviator to apply NOE flight to the tactical situation. The emphasis is on tactical mission planning, operating in the electronic warfare environment, and mission accomplishment. Further emphasis is placed on continuing the development of navigational skills, cockpit teamwork, and pilot technique. Phase II consists of flight periods (FP) 5 through 10 and, with the exception of FP 10, is designed for a single aircraft working in conjunction with a ground force. FP 10 serves as an introduction to section/platoon training and is a multiship operation. The training should be conducted utilizing operation orders, with the aviator conducting his own tactical mission planning. Training should be conducted in training boxes (discussed later in this paragraph) requiring the aviator to plan his own routes. The instructor pilot is given the flexibility to add complexity (e.g., en route mission changes) and realism to the training. During training, safety and control (S&C) pilots act as the point of contact for simulated ground and aviation units and assist the instructor pilot in creating tactical complexity and realism.

The tenth flight period is followed by a comprehensive evaluation flight which will test the aviator's ability to correctly perform NOE flight and navigation and satisfactorily plan an NOE mission.

The flight training provides a total of 21 hours of training per aviator. Of this time, 15 hours is navigation related training and 6 hours deals with training NOE flight maneuvers. The typical flight period allocates 30 minutes for flight maneuvers and 1 1/2 hours for navigation training. The 30 minutes for flight maneuver training does not include the time the aviator spends flying on the route. If the distance to refueling facilities does not allow a flight period of 2 hours, the flight maneuver training should be removed and consolidated into additional periods.

Prior to each flight period, an administrative mission briefing will be held and should include, but not be limited to, weather,

hazards map check, operator's manual performance charts check, safety class, communications - electronics operation instructions (CEOI) and radio security procedural review, and discussion of emergency procedures. Following each flight period, a mission debriefing will be held and should include an aviator critique by the instructor pilot, hazards map update, and assignment of the following day's mission to include the route or training box. Prior to conducting each NOE flight, appropriate aircraft power checks will be made. Suggested training objectives for each flight period are discussed in the following table.

FLIGHT PERIOD	MANEUVER/PROCEDURE	FLIGHT TIME PER AVIATOR	TOTAL
FP 1			1:30/1:30
	Mission Briefing		
	Demonstration, explanation, and practice.		
	a. Preflight procedures (not included in flight time).		
	b. Hazards to NOE flight (not included in flight time).		
	c. Area orientation and access route (not included in flight time).		
	d. Discuss emergency procedures (not included in flight time).		
	e. NOE flight.	(1:30)	
	(1) Forward, dash (forward flight from a standstill), lateral, and rearward flight.		
	(2) NOE approaches (upwind and downwind).		
	(3) NOE takeoffs (upwind and downwind).		
	(4) Hover out of ground effect (OGE).		
	(5) Hovering turns (in and out of ground effect).		
	(6) Quick stop.		
	f. NOE navigation.		
	g. Pilot eye and head coordination.		
	h. Shutdown procedures (not included in flight time).		
	i. Postflight procedures (not included in flight time).		
	Mission Debriefing		

DESCRIPTION: The instructor pilot demonstrates and explains NOE flight and navigation. The instructor pilot discusses hazards and emergency procedures. The aviator practices NOE flight, low level autorotations, and time permitting, NOE navigation.

PERFORMANCE OBJECTIVES: The aviator must demonstrate the requisite control of aircraft to properly perform NOE flight. He will satisfactorily accomplish low level autorotations and discuss emergency procedures that are critical during low level, contour, and NOE flight.

FLIGHT PERIOD	MANEUVER/PROCEDURE	FLIGHT TIME PER AVIATOR	TOTAL
FP 2			2:00/3:30
	Mission Briefing		
	Demonstration, explanation, and practice.		
	a. Review NOE flight maneuvers.	(0:30)	
	b. Use of tactical maps. (1) Map study. (2) Terrain interpretation.		
	c. NOE navigation. (1) Techniques. (2) Checkpoint identification (map/terrain correlation). (3) Accuracy.	(1:30)	
	d. Cockpit teamwork - pilot and copilot/observer.		
	e. Communication - tactical calls and position reports (insuring radio discipline and voice security).		
	Mission Debriefing		
	DESCRIPTION: The crew will navigate/fly a preplanned route to an accuracy of 100 meters. The training will emphasize checkpoint identification. Proper communication techniques will be utilized. The instructor pilot will assist as required.		
	PERFORMANCE OBJECTIVES: The aviator must demonstrate his knowledge of map reading, terrain analysis, and checkpoint identification. He must demonstrate his ability to fly the aircraft in an NOE environment. He must also demonstrate his knowledge of proper communication techniques to include use of CEOI, radio discipline (internal and external), and security (use of CEOI).		
FP 3			2:00/5:30
	Mission Briefing		
	Review and practice of previous maneuvers.		
	a. NOE flight maneuvers.	(0:30)	
	b. NOE navigation.	(1:30)	
	c. Cockpit teamwork.		
	d. Hazards to NOE flight.		
	e. Emergency procedures.		
	Demonstration, explanation, and practice.		
	a. Masking/unmasking techniques.		
	b. Radio security and jamming countermeasures.		
	Mission Debriefing		
	DESCRIPTION: The aviator practices all previous NOE maneuvers. The instructor pilot (IP) will demonstrate and the aviator will practice masking and unmasking techniques. The aviator will make all radio calls and will recognize radio jamming and demonstrate knowledge of the correct countermeasures.		
	PERFORMANCE OBJECTIVES: The aviator must demonstrate his ability to perform masking/unmasking maneuvers. During NOE flight, he is required to remain masked to the maximum extent possible. He will continue to show his proficiency in NOE flight and navigation.		

FLIGHT PERIOD	MANEUVER/PROCEDURE	FLIGHT TIME PER AVIATOR	TOTAL
FP 4			2:00/7:30

Mission Briefing

Review and practice of previous maneuvers.

a. NOE flight maneuvers. (0:30)

b. NOE navigation. (1:30)

c. Cockpit teamwork.

d. Masking/unmasking techniques.

Demonstration, explanation, and practice.

a. Aerial photo study (not included in flight time).

b. Operation under conditions of radio silence.

Mission Debriefing

DESCRIPTION: The aviator will practice previously learned maneuvers. The instructor pilot will discuss and demonstrate the use of aerial photographs to confirm map accuracy and to navigate. The flight will be conducted under conditions of tactical radio silence except between the instructor pilot and S&C aircraft for required reports.

PERFORMANCE OBJECTIVES: The aviator must demonstrate his mastery of previously learned maneuvers. He will show knowledge of the correct techniques of aerial photo study. All control points will be crossed on time.

FP 5 2:00/9:30

(OPORD 1) *Mission Briefing*

Review and practice of previous maneuvers.

a. NOE flight maneuvers. (0:30)

b. NOE navigation. (1:30)

Demonstration, explanation, and practice.

a. Mission planning (not included in flight time).

(1) Map reading.

(2) Route, landing zone, reconnaissance, and firing point selection.

(3) Aerial photo interpretation.

(4) Use of suppressive fires.

(5) Radio procedures and security.

b. Coordination with ground forces (not included in flight time).

c. Range estimation.

d. Mission changes.

(1) Route deviation (to a preplanned alternate).

(2) Mission feasibility.

(3) Command coordination.

Mission Debriefing

DESCRIPTION: The instructor pilot will issue an operation order and assist the aviator as required in the conduct of mission planning and route selection. The aviator will plan the route to take maximum advantage of cover and concealment and plan the employment of suppressive fires. The instructor pilot will discuss coordination with friendly ground forces especially air defense units. The instructor pilot will discuss and demonstrate range estimation at NOE altitudes. The aviator will accomplish an en route mission change to a preplanned alternate route.

PERFORMANCE OBJECTIVES: The aviator must demonstrate his proficiency in NOE flight and navigation. En route accuracy to 100 meters is required. The aviator will demonstrate proper masking/unmasking techniques. The aviator will show sound tactical judgment during the mission change.

FLIGHT PERIOD	MANEUVER/PROCEDURE	FLIGHT TIME PER AVIATOR	TOTAL
FP 6 (OPORD 2)			2:00/11:30

Mission Briefing

Demonstration, explanation, and practice.

a. NOE flight with the M-24 CBR protective mask.

Aviator demonstrates knowledge/ability.

a. Mission planning.
b. NOE flight maneuvers with CBR mask. (0:30)
c. Masking/unmasking techniques.
d. NOE navigation. (1:30)
e. Cockpit teamwork.
f. Adaptability to mission changes.

Mission Debriefing

DESCRIPTION: Maneuvers learned in previous flight periods will be reviewed and practiced. The aviator will plan and fly a mission based on the second OPORD. During the mission the instructor pilot will provide the aviator with a mission change. Flight with the M-24 should be of sufficient duration to familiarize the aviator with the problems associated with the mask.

PERFORMANCE OBJECTIVES: The aviator must demonstrate his ability and knowledge in planning and executing a mission correctly using NOE flight procedures. In addition, he must demonstrate adaptability during assigned mission changes with proper awareness and reaction to threat. He must demonstrate ability to fly while wearing the protective mask.

FP 7 (OPORD 3)			2:00/13:30

Mission Briefing

Aviator demonstrates knowledge/ability.

a. Mission planning.
b. Coordination with ground units.
c. NOE flight maneuvers. (0:30)
d. Masking/unmasking techniques.
e. NOE navigation. (1:30)
f. Cockpit teamwork.
g. Proper radio discipline and security.

Mission Debriefing

DESCRIPTION: Maneuvers learned in previous flight periods will be reviewed and practiced. The mission will be planned and flown by the aviator.

PERFORMANCE OBJECTIVES: The aviator must make sound tactical decisions - thoroughly plan the mission, properly execute the plan, and demonstrate proficiency in NOE flight and navigation. Proper radio discipline and security must be exhibited throughout the flight.

FLIGHT PERIOD	MANEUVER/PROCEDURE	FLIGHT TIME PER AVIATOR	TOTAL
FP 8 (OPORD 4)			2:00/15:30
	Mission Briefing		
	Demonstration, explanation, and practice. *a.* NOE flight with loads.	(0:30)	
	Aviator demonstrates knowledge/ability. *a.* Mission planning. *b.* Coordination with ground forces. *c.* Masking and unmasking techniques. *d.* NOE navigation. *e.* Cockpit teamwork. *f.* Radio discipline and security.	(1:30)	
	Mission Debriefing		
	DESCRIPTION: The instructor pilot will demonstrate and the aviator will practice NOE flight maneuvers with an internal load. The mission will be planned and flown by the aviator. *Note: For those aviators not currently proficient operating with loads, additional time probably will be required.* PERFORMANCE OBJECTIVES: The aviator must demonstrate the ability to utilize the operator's manual performance charts to determine allowable cargo load, density altitude, and fuel consumption. He must demonstrate the requisite aircraft control during flight. The aviator must demonstrate proficiency in the planning and execution of the mission to include selection of suitable routes, accurate navigation, and proper use of the terrain for masking. Radio discipline and security will be observed throughout the mission.		
FP 9 (OPORD 5)			2:00/17:30
	Mission Briefing		
	Demonstration and explanation. *a.* Air-to-air evasive techniques.	(0:30)	
	Aviator demonstrates knowledge/ability. *a.* Mission planning. *b.* Coordination with ground forces. *c.* Masking/unmasking techniques. *d.* NOE navigation. *e.* Cockpit teamwork.	(1:30)	
	Mission Debriefing		
	DESCRIPTION: The IP will explain and demonstrate air-to-air evasive techniques against helicopters and high performance aircraft. The mission will be planned and flown by the aviator. PERFORMANCE OBJECTIVES: The aviator must satisfactorily accomplish the mission utilizing NOE flight. During this flight the instructor pilot should not assist the aviator.		

FLIGHT PERIOD	MANEUVER/PROCEDURE	FLIGHT TIME PER AVIATOR	TOTAL
FP 10 (OPORD 6)			1:30/19:00
	Mission Briefing *Aviator demonstrates knowledge/ability.* *a.* Mission planning (team mission). *b.* Coordination with ground forces. *c.* NOE navigation. *d.* Cockpit teamwork. *e.* Teamwork with other aircraft. *f.* Operations under radio silence. *Mission Debriefing*	(1:30)	
	Note: This period should be used for additional instruction if the aviator has failed to master a particular terrain flight subject area.		
	DESCRIPTION: During this flight period, the aviator will practice a multiship operation which will serve as an introduction to the section/platoon training phase of advanced training. The aviators undergoing training will develop a well-coordinated and timed plan of operation and execute the plan. The mission will be conducted under conditions of radio silence except communication between the instructor pilot and S&C aircraft for required position reports. PERFORMANCE OBJECTIVE: Each aviator will satisfactorily perform as a member of the team during both mission planning and execution.		
FP EVALUATION RIDE			2:00/21:00
	DESCRIPTION: The evaluation ride will be conducted as an NOE mission and the aviator will be evaluated on his ability to satisfactorily accomplish the mission. PERFORMANCE OBJECTIVES: The planning will be thorough and complete and will demonstrate that the aviator understands mission planning principles concerning route, landing zone, and firing point selection; use of suppressive artillery fires; the use of smoke, chaff, and radar jammers; and coordination with ground units (especially friendly air defense). The aviator will correctly conduct NOE flight. He will properly use the terrain to mask his movements and demonstrate proper unmasking techniques that limit his exposure time to less than 10 seconds. He will navigate to an accuracy of at least 100 meters (6 digits). He will display proper radio discipline and security. Cockpit teamwork will be displayed. He will be knowledgeable concerning the employment of Army aviation and his unit and aircraft. He will be able to demonstrate or discuss critical emergency maneuvers.		

Initial Qualification Flight Training Areas

Four NOE training routes and six training boxes will be required for each crew to conduct initial qualification flight training so that no aviator flies the same route or in the same training box twice. A training box is an area in which the aviator plans his own route within given boundaries. Each route should be at least 40 kilometers long (start point (SP) to objective to release point (RP)). The size of each training box should provide the aviator several route possibilities - ideally one of which will be more tactically sound than the others. Up to four crews (one crew per route) can be trained simultaneously if four routes and six boxes are available. More crews will require additional routes and training boxes. Map B (insert) depicts a training area in which four routes have been plotted. The routes as plotted provide separation so that all four routes can be used simultaneously. The total space required could be reduced by plotting routes three and four over the same general area as routes one and two but over different terrain (several hundred meters left and right of routes one and two). If this is done, only routes one and two or three and four could be used simultaneously. The six training boxes will generally require a larger area than do the four routes and when possible should not cover the same general area as the routes. The total space required for the boxes can be reduced by overlapping the boxes if they are not used simultaneously.

The route selection considerations presented in paragraph 1-4 should be used in conjunction with the following guidelines when selecting NOE routes for initial qualification training. When applicable, these guidelines should be used by an aviator planning an NOE route in a "training box" as well as for the preplanned routes.

- Routes should be long enough to allow the aviator to navigate for 1 1/2 hours without having to repeat a portion of the route. A distance of 20,000 meters from the start point to the objective is generally sufficient (total route (start point to release point) 40,000 meters).
- Routes should provide a minimum distance of 1,000 meters between any two routes to be flown during the same training period. This permits the aviator latitude in his navigation exercise, yet provides separation when aircraft are operating on adjacent routes. Also, routes should be plotted from the start point to the objective and back on the same side of the training area for each route. For example, if the routes generally run north and south, than all the "up" (start point to objective) legs should be on the east and "down" (objective to release point) legs on the west.
- Routes should facilitate the use of air control points.
- Routes should be planned to minimize the possibilities of wire strikes and provide a minimum separation of 100 meters distance when paralleling wires.
- Routes should be plotted to provide a minimum distance of 200 meters from houses, churches, schools, chicken coops, and other sensitive areas.

3-4. FLIGHT TRAINING TECHNIQUES OF INSTRUCTION

The instructor pilot should be given the incentive and responsibility to develop a training environment designed for the individual aviator. He must be allowed to determine the intensity of the in-cockpit instruction. Through this instruction the vital skills, knowledge, and lessons learned are conveyed to the aviator. Comprehension of various aspects of training varies greatly with the individual, and the aviator should not proceed to the next higher plateau of training complexity until he has mastered the lower. The person best qualified to judge when the aviator is ready for his next step is the instructor pilot. By varying the problems and tasks assigned from within the cockpit on a day-to-day basis with the degree of difficulty increasing, the aviator's level of comprehension and retention is controllably increased.

Terrain flight instruction not only emphasizes the need for "hands on" training, but also for mental projection ahead of the aircraft. The aviator must be allowed to think for himself, make his own radio calls, and make his own decisions while flying the aircraft. The instructor pilot serves not only as an instructor, but also as a catalyst for provoking thought. This dual role requires an instructor pilot of the highest caliber. The success or failure of the training will rest primarily upon his shoulders.

Flight maneuver instruction

The instruction should encompass a review of pertinent low level and contour flight maneuvers as well as teaching flight maneuvers peculiar to the NOE environment. Included in these are approaches, takeoffs, masking/unmasking, quick stops, and in-ground-effect and out-of-ground-effect hovering and emergency procedures. Instruction should also include low level autorotations. During this training it is important that the instructor pilot emphasize precise execution of flight maneuvers. Clearance judgment should also be emphasized during flight training.

Navigation instruction

During academic training instruction, the aviator is taught the proper procedures for effective and accurate map reading and terrain interpretation. It follows that during flight training instruction, the instructor pilot must insure that the proper methods and techniques of navigation are rigorously applied. The objective of navigation instruction is for the aviator to be able to locate the objective 100 percent of the time and to pinpoint the aircraft's location to within 100 meters at all times. Also, he must arrive at the objective on time. If the aviator becomes disoriented or is having difficulty with a specific aspect of his navigational technique, the instructor pilot should assist by pointing out his weakness

or error once he determines that the aviator will be unable to correct the faults himself. During Phase II - Tactical Orientation, it is important that the instructor pilot encourage the aviator to learn finesse in his route selection and en route navigation. For example, a route following a streambed selected during mission planning may look good because it appears to follow the lowest contour. However, hardwood trees commonly grow in streambeds and the tops may be considerably higher than the tops of the pines on the surrounding higher ground. In this case, the crew should deviate the course to follow the lowest contour in the vegetation. It is still critical that the crew know its position to within 100 meters.

Instruction related to tactical employment must be realistic. Therefore, it should be understood that there is no "school solution" to any tactical problem posed to the aviators. There are a number of possible courses of action, each with strong and weak points and with differing probable results when applied to varying situations. In the early phases of training, the instructor pilot should point these out and then allow the aviator to make the decision for himself. In the later stages the aviator will arrive at his choice and implement it without any instructor pilot assistance or advice. If, however, the aviator makes a poor tactical decision or places his ship in simulated peril through inadvertent exposure to the enemy threat, the instructor pilot should conduct an immediate critique, explaining to the aviator his mistake and the consequences of his error. This may be done at a slightly higher hover so that the terrain may be used to clarify the error. It may be necessary to reorient the aviator to allow execution of a better approach and continuation of the mission.

Tactical instruction

Formal grading of flight training progress is not necessary, but the instructor pilot should debrief the aviators after each flight on their manner of performance and progress or lack of progress. The evaluation flight should be graded as pass or fail. It is essential that the standards used adequately reflect the individual's competency. If he can't find the objective 100 percent of the time, he can't accomplish the mission no matter how well he satisfies the other performance objectives. Depending on local policies or individual instructor preference, instructor pilots may use informal notes or printed grade slips as an aid to the conduct of daily flight debriefings.

Grading

3-5. TRANSITION TRAINING

If the aircraft used as the primary training vehicle during initial training is not the aircraft the aviator will normally fly, he should receive additional NOE training in the aircraft he will normally fly. Normally, 2 to 5 hours are necessary for this transition. This training is necessary because of the differences in the way a particular maneuver looks and feels between aircraft and in certain cases, such as an autorotation, differences in how the maneuver is accomplished. For example, the quick stop feels different in a Cobra as compared to an OH-58 because the pilot sits so much higher in the Cobra. This training should be accomplished prior to conducting advanced training. As a minimum, the training should include demonstration and practice of NOE flight, hover out of ground effect (to include masking and unmasking techniques), the quick stop, and emergency procedures.

SUMMARY

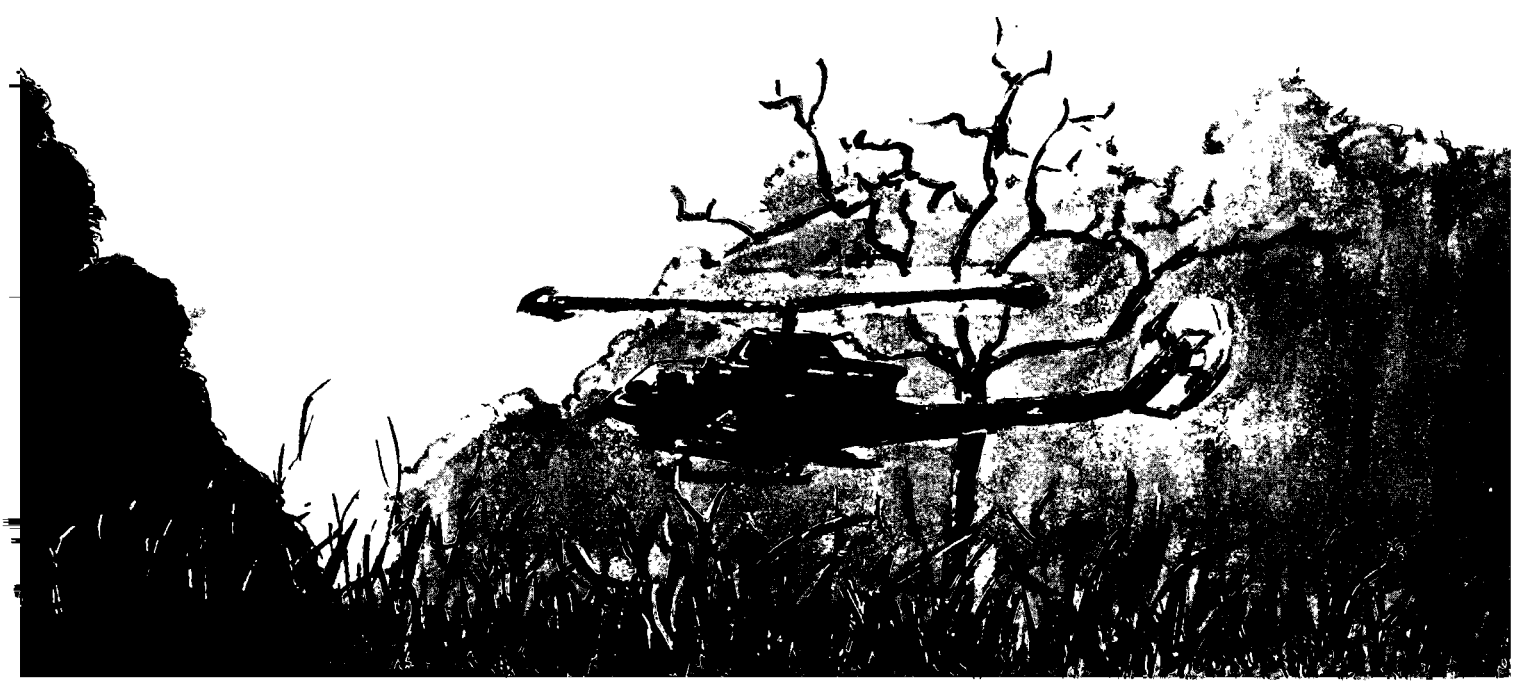
Initial qualification training consists of academic and flight training. Academic training is a 34-hour program divided into six training blocks. Flight training is a 22-hour program designed to teach navigation, NOE flight maneuvers, and obstacle clearance. Qualified instructor pilots are required to conduct all flight instruction. The most suitable aircraft for conducting initial qualification training is the UH-1 since the instructor and pilot sit in the crew seats. In the UH-1, an aviator can sit in the jump seat and navigate, thereby allowing an instructor pilot to train two aviators simultaneously.

Primary objectives of the initial qualification training include:

- Knowledge of the high threat environment.
- Knowledge of tactics to use against the threat.
- Qualification of the aviator in NOE flight and refresher training in low level and contour flight.
- Performance of NOE navigation to a 100-meter accuracy to find the objective 100 percent of the time and refresher training in low level and contour navigation.
- Thorough mission planning and selection of a masked route.
- Knowledge of human fatigue and perception factors during flight.

Terrain flight training should emphasize "hands on" training and a no "school solution" atmosphere to allow the aviator to learn to make decisions for himself. Grading during instruction is not necessary, but the student should be thoroughly debriefed after each period on the manner of performance and degree of progress.

After completing this initial training course, the aviator will possess the basic *individual* knowledge and skills to progress to the advanced training level. During advanced training, he will refine these skills and apply them to unit operations.



CHAPTER 4

Advanced Training

Upon completion of the initial qualification course and with previous training and experience, the aviator is able to employ the techniques of terrain flight to move about the battlefield undetected. However, he is not yet ready to engage a sophisticated enemy. He must learn to use his terrain flying skills as a member of a section, platoon, or company team and be able to operate effectively at night and in adverse weather. Advanced training will prepare him to accomplish these tasks.

4-1. CONCEPT

In the future, night combat engagements will probably be as common as those during daylight. Aircrews must be able to function around-the-clock. Darkness works to our advantage because it restricts the ability of the enemy to locate us visually; however, it does not reduce his radar detection capability. Therefore, terrain flying is as fundamental at night as during the day and is an important advanced training objective.

Advanced training objectives also include unit training. Here it's all put together with mission accomplishment the primary objective. Unit training must realistically reflect the actual high threat environment. Commanders (aviation and ground) and aviators must plan each mission as if the simulated enemy is real. The unit cannot train properly if it must perform NOE only on established routes. The unit must have the freedom to operate NOE, contour, or low level anywhere within its training area except where hazards present an unacceptably high safety risk. If archaic rules restrict unit training so that it is not realistic for the high threat environment, the unit will not be prepared to conduct its mission in combat.

Prerequisites for Advanced Training

To participate in advanced training, the aviator must have successfully completed an initial qualification course so that he is capable of performing NOE flight/navigation and is

familiar with the high threat environment. He should also be proficient in low level and contour flight/navigation. Aviators who received initial qualification in another unit should demonstrate their terrain flight (especially NOE) proficiency and knowledge of the high threat environment prior to participating in advanced training. In certain cases, refresher training may be required. Refresher training should be specifically tailored to the individual's needs.

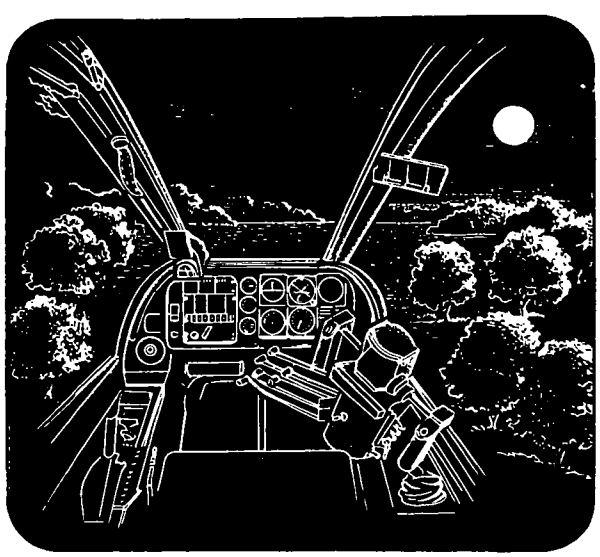
Advanced Training Areas

The training area will, to a large measure, be determined by the type training to be accomplished. The guidelines discussed pertaining to initial training areas (paragraph 3-3) are generally applicable to advanced training areas; however, significantly larger areas will be required because faster low level and contour flight as well as NOE will be flown. Additionally, a larger number of aircraft may be operating in the training area. The specific area size will be influenced by the unit mission. For example, the assault helicopter company (AHC) will require a relatively large training area with numerous landing zones to practice the methods of employment it will utilize in the high threat environment. The attack helicopter unit should select training areas which offer the maximum number of type of firing positions (depressions, tree lines, ridgelines, buildings) and terrain which allows the commander freedom to experiment with his methods of employment.

Night training should be conducted over US Government – owned property when practical. This precludes the problems and hazards of disoriented aircraft inadvertently flying over restricted areas (homes, barns, livestock, and crops). This also provides a "controlled construction" environment which minimizes the hazard of man-made obstacles. Also, night terrain flying should be conducted only on preplanned routes which are planned and reconnoitered during daylight prior to the flight.

4-2. NIGHT TRAINING

The training necessary to prepare a unit to conduct terrain flying at night should be designed to progress from a highly controlled, relatively simple, low level, single aircraft exercise toward an advanced level of multiple aircraft utilizing low level, contour, and NOE flight as required based on the tactical situation. Night training should begin in the classroom. Conventional night vision proficiency refresher exercises can be conducted simultaneously and used to bridge the gap between the classroom and advanced team tactics at low altitudes under low light levels. The high threat environment should be included in both classroom instruction and simulated in all tactical training exercises. Whenever possible, ground surveillance radar teams, to include air defense weapons, should be used to detect and report aircraft to simulate the threat and evaluate training. Night vision devices should become an integral part of the overall night training program as they become available.

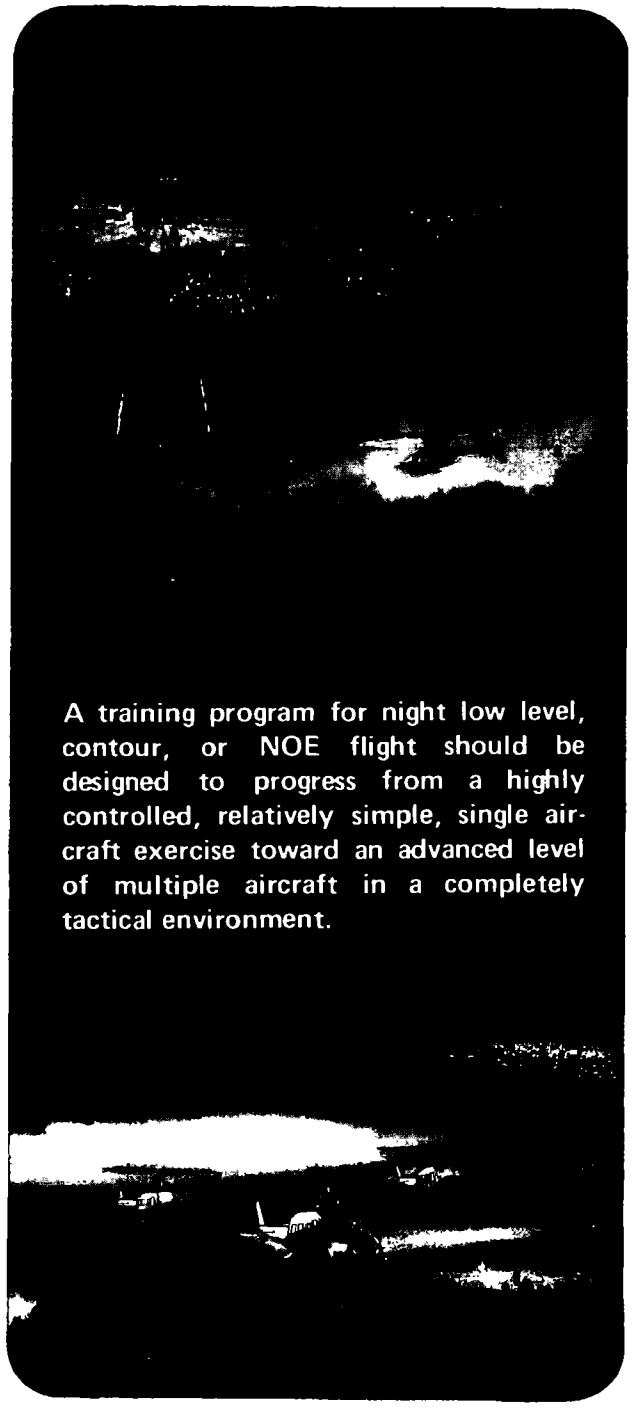


At night, maximum altitude restrictions are determined by the threat and masking, and minimum altitude restrictions are determined by ambient light and visibility.

Training should begin under a high light level and progressively continue to lower ambient light conditions. (High, medium, and low light levels correspond to full moon, half moon to quarter moon, and no moon, respectively.) Phases of training may be further subdivided into nontactical and tactical subphases. Altitude bands should be established within phases and lowered as proficiency increases. Evaluation flights should be integrated into training to verify proficiency prior to proceeding to a lower altitude. Multiaircraft operations introduce another facet of unit training and further increase the intensity of training. For example, the interval between aircraft within the exercise (or mission) must be considered, controlled, and progressively reduced from an extended interval to the close interval necessary for the particular tactical formation. Variations in aircraft loads and terrain environment is essential to simulate realistic combat operations. Navigation should be emphasized throughout training. Target detection, identification, and acquisition of targets should be integrated into each light level of each phase of training whenever possible.

■ *Initial night training program.* The initial night training should prepare the aviator to perform night low level and contour flight without the use of night vision devices. When night vision devices become available, the program should be expanded to train all unit aviators to be proficient and qualified in a night low level, contour, and NOE flight using the night vision devices. Initially, training programs should be intensive to insure maximum retention.

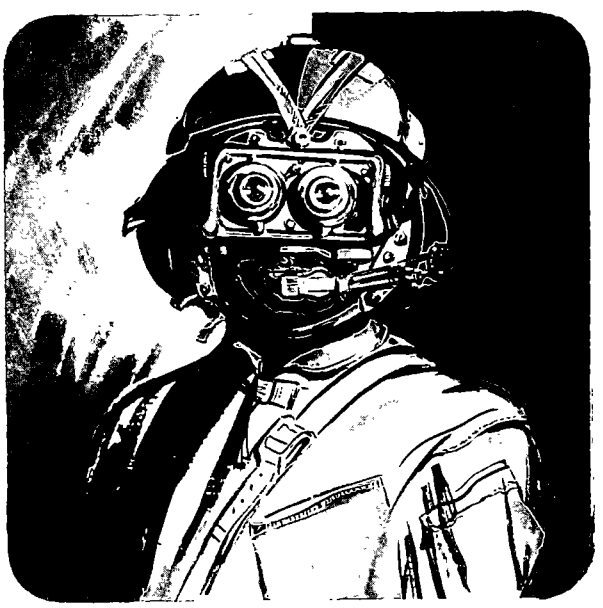
■ *Proficiency training.* As the unit becomes proficient in the techniques of night flight, this proficiency must be maintained. Skills learned during the initial night training program must not be allowed to deteriorate through inactivity. Continuous night flight training must become an integral part of the unit's overall training program. Ingenuity and innovative methods are encouraged in organizing an effective program to coincide with the accomplishment of the unit mission.



A training program for night low level, contour, or NOE flight should be designed to progress from a highly controlled, relatively simple, single aircraft exercise toward an advanced level of multiple aircraft in a completely tactical environment.

The aviator must be proficient in night low level and contour flight with the unaided eye prior to beginning NOE training with night vision devices.

Low level and contour flight can be conducted at night with the unaided eye. With night vision devices, the crew can also conduct nap-of-the-earth flight.



During training, precautions should be undertaken to assure the psychological readiness of the aviator to cope with the problems of night flight. To achieve a positive mental state, the training program must instill aviator confidence in his ability to conduct night flight, and eliminate unnecessary distractions which may hinder the learning process. If these conditions are fully understood, the anxiety and fear which are sometimes associated with night flight are relieved and the aviator's learning rate will steadily increase.

Night flight is physically more demanding than flight in daylight and requires greater emphasis be placed on the physiological needs of the aviator. The aviator's night vision is affected by sleep, nutrition, physical training, and the use of alcohol or tobacco.

As a minimum, two qualified aviators or an aviator and qualified aeroscout observer are required to conduct night terrain flight. However, due to the additional stresses and requirements associated with night terrain flight (especially NOE), it should be performed by two aviators when possible. It is further recommended that helicopters which are capable of carrying additional crewmembers do so to assist in terrain recognition.

Night training is a critical requirement and it must not be neglected. Low level and contour flight, unaided by night vision devices, can be performed safely, and it is essential to begin training now. Night vision devices (AN/PVS 5 night vision goggles) will be phased into the Army in the immediate future. These will create additional emphasis on night NOE flight because we can train in a realistic manner. When this occurs, the unit which has already conducted night low level and contour training will be ahead of the game.

TC 1-28, Rotary Wing Night Flight, is designed to assist the commander in developing a night training program and includes a typical master training schedule. It explains "how" to conduct night low level, contour, and NOE flight; discusses night mission planning; and provides operating instructions and training guidance for the night vision goggles.

4-3. UNIT TRAINING

Unit training should be designed to convert the individual skill and knowledge of each aviator into unit proficiency. This involves developing teamwork, standing operating procedures, and coordination procedures. It also includes individual training in the mission operational requirements peculiar to a specific mission or aircraft. For example, the attack helicopter pilot must be proficient in NOE gunnery if he is to accomplish his mission. The scout must learn the visual observation techniques to be used while NOE. The utility pilot must learn to carry sling loads while conducting contour and low level flight. These training requirements exist because the techniques required to accomplish these tasks differ at the low altitudes associated with terrain flying. In most cases the mission operational requirements can be taught with minimum formal instruction. However, NOE gunnery and observation procedures and techniques require a specialized training program.

Unit training is mission oriented and is tailored to the specific unit. Although there are many ways to accomplish unit training, the following guidelines will assist in developing the training program:

- In developing the unit training program, the commander should first identify the specific tasks required for the unit to accomplish its mission. The Army Training and Evaluation Program (ARTEP) for the unit will assist him in determining these tasks. He can then evaluate the effect of terrain flying on each task and determine his specific training requirements.

- The training should be developed beginning with the lowest echelon and continuing to the highest echelon of the unit which would normally operate as a whole. In the case of the Air Cavalry Combat Brigade, this could be the battalion. In the case of an Air Ambulance Company, team training of two or three aircraft would be the highest echelon because the company will rarely accomplish its mission with more aircraft. The training should include development and practice of the coordination and operational procedures between adjacent units.

- The platoon leader should be a primary training manager. This is especially important in units where the platoons or the platoons' elements could be expected to operate independently.

- The control procedures used during training should realistically reflect those which will be used in combat.

- Each flight should be conducted under a simulated tactical situation and executed in accordance with the situation. For example, if a flight were point to point and solely behind the division rear, 500 feet AGL might be a suitable altitude. When operating along a simulated FEBA, NOE must be employed as necessary to avoid detection.

- As the unit learns the trick of moving realistically, under control, there is virtually unlimited opportunity to introduce various combat situations. The training should continually progress in difficulty by the inclusion of various combat situations. Whenever possible, ground surveillance radar teams, to include air defense weapons, should be used to detect and report aircraft to simulate the threat and evaluate training.

- Training should be conducted in conjunction with ground units to the maximum extent possible to help educate the ground commander as to aviation operations in the high threat environment.

- At least one-third of all unit training should be conducted at night.

- Training should periodically be conducted in areas that are unfamiliar to the crews in order to maintain navigational proficiency. This is critical because in combat a unit may not operate in an area for extended periods. Because navigation is the most difficult task associated with terrain flying, crew and individual proficiency must be maintained if missions are to be accomplished satisfactorily.

■ During team, section, and higher echelons of unit training, battle drill type training should be emphasized. The training must instill an instinctive and habitual reaction to specific and specialized tactical situations to eliminate confusion and reduce the need for radio transmissions.

■ Communication discipline and security must be emphasized throughout unit training.

■ When the unit has become proficient in conducting terrain flight in clear weather, the training emphasis should be shifted to more adverse weather conditions in order to increase the unit's staying power. The skills that the aviator has learned relating to night flight, battle drill, and thorough planning are especially applicable to adverse weather training.

■ The key factor for successful unit training is *realism.* In peacetime we live and train in a garrison environment. Tactical units are too often overburdened with administrative support requirements that conflict with their tactical training. Unit commanders are faced with many other "squeezes on training" such as personnel shortages and turbulence, budgetary constraints, and ever-increasing maintenance requirements. There must be a unilateral effort by everyone - from private to senior commander - to make our training simulate actual combat. We must practice as we intend to fight.

Realism is the key to successful unit training.

4-4. AIR CAVALRY UNIT TRAINING CONSIDERATIONS

The air cavalry unit in the high threat environment will extend by aerial means the reconnaissance and security capability of the parent or support unit, and will engage in offensive, defensive, or delaying action within its capabilities. It will work closely as a member of a combined arms team with other aviation and ground units. Since the unit will be employed extensively along the forward edge of the battle area, it must be highly proficient in day and night terrain flight. It must also be able to operate in adverse weather.

The training should initially be concentrated in each platoon and associated with the specific platoon mission, i.e., reconnaissance, attack, and transport. As each platoon develops proficiency in its mission area, it will begin to train with the other platoons in order to develop teamwork, coordination, and proficiency. The training is developmental, beginning with individual training in the operational mission requirements and continuing to accomplish the platoon mission and the unit mission.

As an example, consider the aeroscout platoon training. The aeroscout platoon's primary mission is to perform reconnaissance. To accomplish the reconnaissance mission, the individual scout pilot must be highly proficient in terrain flight techniques, in visual observation techniques and procedures, glare reduction techniques, and adjustment of artillery. Observation techniques and procedures are discussed extensively in FM 1-80.

Aircraft size appreciation training is particularly important to the scout since his reconnaissance mission requires that he (while operating close to the enemy) use every possible terrain feature to mask his movement. Therefore, he must be able to determine immediately and with a high degree of accuracy if he can go between obstacles or whether he must go over or around them. A gate system, discussed in the preliminary training course in appendix B, would be suitable for early training. As his proficiency increases, the scout should receive training on a terrain obstacle course which requires the aviator to negotiate a series of carefully selected terrain and/or vegetation obstacles.

IR suppressive paints and other physical precautions relating to the aircraft (i.e., removing windows) can help reduce glare. However, the scout should know how to use vegetation and shadows to reduce glare. For example, he should look through vegetation rather than over it. He should stay in the shadows of a tree, building, or terrain feature. These techniques should be emphasized and practiced during training.

As the scout's proficiency and knowledge increase, he should begin operating in tactical boxes. This training should emphasize location and identification of the enemy without being detected. The training can be enhanced if a grading system is integrated to record simulated enemy sightings of the scout aircraft.

When the scout has learned to accomplish the reconnaissance mission independently, he should learn to operate as a member of a reconnaissance team and then as a member of the team formed from elements of the other platoons to accomplish other unit missions such as security. At this and higher levels of unit training, control becomes a critical operational and training requirement. The development of control and coordination primarily requires practice. Another important training requirement is for the elements to learn to work together for mission success. In team or section training, a valid tool which will assist in developing this teamwork is for the leader to include the other members of the team/section in the planning sequence.

A key point to be stressed during team, section, and higher echelon training is the necessity to be continually aware of the location of the other aircraft. When each aircraft is masked from the enemy, they will often find that they are masked from each other. Coordination and the use of battle drill techniques are required to insure aircraft separation in the terrain flight environment.

Proficiency in "overwatch" and related techniques are essential for aviation units, especially air cavalry and attack helicopter units. Employment of overwatch is as critical for the success of an aviation unit as it is for the ground unit. The overwatch techniques - one element prepared to fire and maneuver to support the other element - are ingrained in ground tactics but are new for aviation. Selection of an overwatch position which allows the cover element to remain masked while remaining in visual or radio contact with the maneuvering element is essential.

Team and section training should also include selection of ambush and firing positions including entry and withdrawal routes for attack helicopters. It should continue to emphasize coordination with ground units and combined arms operations.

In platoon and troop training the techniques are the same as used for team and section training. However, the larger unit requires more detailed planning, greater emphasis on timely execution of the plans, coordination, and applicaion of combined arms tactics.

4-5. ATTACK HELICOPTER UNIT TRAINING CONSIDERATIONS

With the arrival of the Cobra Tow (AH-1Q) attack helicopter, the Army now has a very effective aviation weapon for use against enemy tanks and mechanized forces. With a Cobra Tow attack helicopter unit or element as a member of the combined arms team, the team has a dynamic new dimension available to influence land combat. The Cobra Tow has added the helicopter's speed and mobility to the combined arms team's tank killing capability. While the firepower of most of the other team members is greatly influenced by terrain, the firepower of the helicopter is not restricted by many of the same terrain limitations. Therefore, the attack helicopter provides a devastating impact that no other system available to the combined arms team can match. Like ground units, Cobra Tow attack helicopter units will achieve their greatest gains when operations are characterized by detailed and methodical planning. The combined arms team commander can also use the Cobra Tow attack helicopter to dominate key terrain, to suppress antiaircraft weapons, and to guard likely enemy armor avenues of approach into the friendly area. The Cobra Tow, properly employed, can keep the opposing motorized enemy off balance, reduce his ability to hold terrain, and dry up his sustaining ability.

The aeroweapons helicopter (AH-1G, Cobra) will be used against a much wider range of targets and in more varied roles than the Cobra Tow. In the high threat environment, the Cobra equipped with smoke and chaff

Attack helicopter units should practice coordinated "live fire" attacks with field artillery.

rockets will assume a new mission of providing concealment for other aviation units. It will also continue to be employed in its more traditional role of attacking targets other than armor, providing overwatch, and providing massed aerial fires.

Recognizing that the employment of attack helicopter elements in the manner described above will be only as good as the state of training these units receive, the question becomes what training should be stressed in these units. The following considerations are generally applicable to all attack helicopter units and should be stressed for training of individuals, sections, and platoons:

☐ Techniques of movement - Here primary emphasis is placed on learning the fundamentals of terrain flying and overwatch. An attack helicopter unit's survivability on future battlefields will depend on how well crews learn these movement techniques.

☐ Target recognition and priorities - The ability of an attack helicopter crew to recognize a priority target, either moving or stationary, cannot be overstated. The success of the mission and the lives of the crew will hinge on who gets the first shot in many cases. Training should stress recognition of enemy air defense artillery (ADA) weapons, armor, and motorized elements.

☐ Shoot and move - Gunnery is the most fundamental operational mission requirement for the attack helicopter crew. The gunnery techniques used at the low altitudes associated with terrain flying include hovering, slow flight, and running. These three basic techniques will normally be used in various combinations against moving and static targets. Gunnery training is discussed in FM 1-40, Helicopter Gunnery, and TC 17-17, Air Cavalry Attack Helicopter Crew Qualification Course. When terrain permits, the helicopter crew should use multiple attack positions to reduce the attacking unit's vulnerability to counterattack. The unit should move quickly to alternate firing positions following the attack.

☐ Selection of firing positions - The keys to position selection are first round hit advantage, protection, and concealment.

☐ Ambush tactics - The Cobra Tow attack helicopter unit is uniquely suited to stage ambushes of enemy armored forces, either singularly or as part of a combined arms force. Speed of movement and attack, along with the massing of Tow missile fires, will be two of the primary keys to the successful ambush. Training in this area should primarily focus on "battle drills" which require minimum aircraft-to-aircraft communications. Platoon and company movements to ambush locations must be practiced until they become second nature to each crew.

☐ Use of artillery - Each attack helicopter crewmember must be fully trained and able to call for and adjust artillery fires on enemy targets encountered on the battlefield. The attack helicopter unit crews must understand artillery trajectories sufficiently to attack a target area while friendly artillery fires are being placed on it. Use of this technique will help suppress supporting air defense weapons and increase the effectiveness of the attack helicopter fires. Artillery can also be used to deliver smoke rounds which will restrict enemy visibility.

☐ Adverse weather flying - Attack helicopter units can and will operate under adverse/mar-

ginal weather and visibility conditions. Only in extremely adverse weather conditions will attack helicopter units have to delay accomplishing a mission. Frequently the attack unit will be able to exploit poor weather to gain a tactical advantage over the enemy. Battle drill in adverse weather flight must be fully developed by the unit.

■ Combined arms team employment Attack helicopters will normally be assigned as part of a combined arms force. All unit crews must be aware of the capabilities of the other team members. The training should emphasize coordination of combined fires with special emphasis placed on the attack helicopter's ability to maneuver and shift fires to another critical area. Also, it should emphasize communications requirements (the EW environment) and methods of providing 24-hour, round-the-clock participation in the combined arms team.

Many attack helicopter units will often perform company and, in some cases, battalion size missions. For this reason, higher echelon training must not be neglected. The considerations discussed in the previous paragraph are also applicable to this training level. However, planning and control are the major training requirements. Timing is important in a large-scale operation. Practice is essential to develop timing.

SUMMARY

Terrain flying is as fundamental at night as during the day. It requires intensive additional training if it is to be conducted satisfactorily. Night training should be designed to progress from a highly controlled, relatively simple, low level, single aircraft exercise toward an advanced level of multiple aircraft using low level, contour, and NOE flight in a tactical situation. Night vision devices, when available, should become an integral part of the overall night training program and continuous night flight training should be practiced to maintain proficiency.

Unit training is designed to convert individual skills and knowledge into unit proficiency. This training involves developing and practicing teamwork, standing operating procedures, and coordination procedures. Unit training should be mission oriented and tailored to the needs of the specific unit. As a general guide, unit training should progress from the lowest echelon and continue to the highest echelon of the unit which would normally operate as a unit. A key factor for successful unit training is realism. If archaic rules restrict unit training so that it is not realistic for the high threat environment, the unit will fail in its mission where it counts - in combat.

CHAPTER 5

Related Training Requirements

5-1. MAINTAINING PROFICIENCY

One of the critical command responsibilities is to insure that unit and individual terrain flying proficiency is maintained. The skills learned in individual qualification and advanced training must not be allowed to deteriorate through inactivity. The commander must insure that adequate emphasis is placed on maintaining proficiency. He can do this by performing all training and testing exercises under simulated conditions of the high threat environment. This will maintain unit proficiency. In addition, the commander should insure individual proficiency in terrain flight by having the aviator demonstrate his skill and knowledge of critical flight maneuvers and navigation techniques. This can readily be accomplished in conjunction with the annual standardization ride. The attack, observation, and utility helicopter pilot should perform NOE flight maneuvers to include forward, dash, lateral, and rearward flight; approaches and takeoffs (upwind and downwind); hovering turns (in and out of ground effect); quick stop; and masking/unmasking techniques. The cargo helicopter pilot should demonstrate his proficiency in contour and low level flight. All aviators should demonstrate navigational expertise. This critical requirement can be satisfied by having the aviator navigate a preplanned NOE (contour) course to an accuracy of 100 meters as part of the standardization ride. In this situation it is important that the aviator not have flown the course previously and that the course be of sufficient difficulty to challenge the aviator.

5-2. REFRESHER TRAINING

When the unit completes its initial qualification course, refresher training must be available. This is necessary for several reasons.

☐ New and more accurate threat data is available and must be disseminated when it alters that taught in initial qualification.

☐ Commissioned aviators will often return to tactical aviation assignments after prolonged periods of nontactical aviation duty. These aviators will require extensive refresher training in the flight maneuvers and updated threat and employment data.

☐ Training may be necessary for those aviators assigned to units which do not normally utilize terrain flying.

☐ Until every aviator is proficient in conducting NOE, the unit will have to train new personnel who did not become qualified in previous assignments.

5-3. TERRAIN FLYING CONFIDENCE COURSE

The terrain flying confidence course (TFCC) is designed to assist the unit commander in developing a training course which will maintain individual aviator proficiency in the basic skills required to perform terrain flight. It is intended for use by those units that do not normally conduct terrain flying and for those individual aviators who perform nonflying duties. Integration on an annual basis of a terrain flying confidence course to the unit training program will provide diversification and will add momentum to unit morale and interest in the overall training program.

Either single aviators or crews can be trained on the TFCC as it is discussed in this chapter. Whenever practical, crews rather than individuals should be trained in order to minimize instructor pilot and aircraft resource requirements.

All aviators who attempt the terrain flying confidence course (TFCC) will have successfully completed an initial qualification course. Training which other elements of the unit receive is incidental to the training objectives of the course.

The TFCC is divided into nine day requirements and two night requirements. These create demand for a particular skill that the aviator must possess to conduct terrain flight and are listed at the end of this paragraph. A brief description of the activity and the performance objectives are listed under each requirement. The requirements are not necessarily listed in the order in which they should be executed during the course. Additional requirements, such as NOE gunnery qualification, based on unit mission or training requirements can be included in the TFCC. The unit commander should design his own program around the limiting factors of terrain, facilities available, range restrictions, and other considerations which may be peculiar to his operation.

The manner of execution should be left up to the aviator's ingenuity to reflect, to a degree, the validity of previous training to which he has been exposed. An instructor pilot (acting as a training evaluator) will insure that safety is maintained and critique the aviator's performance throughout the course. In addition, the instructor pilot will do what is asked of him by the aviator, within the framework of the requirement. For example, since the aviator must perform both navigation and flying tasks separately, the instructor pilot will fly while the aviator navigates, and vice versa.

To a great extent, evaluation of the aviator's performance will be subjective. Only a satisfactory or unsatisfactory rating will be awarded each performance of a requirement. Based on the critique provided by the instructor pilot, the aviator will know where future training emphasis must be applied.

Requirement 1

Nap-of-the-Earth Flight.

Description. The aviator must plan for his flight by first making a detailed map reconnaissance of the preplanned route to include a terrain analysis and hazard study. He will then fly the entire route using NOE techniques.

Performance objectives. The aviator must show knowledge of map reading and must correctly interpret the map symbology as to the type of terrain he will be negotiating. He will talk the instructor pilot through the entire course route, explaining techniques to be used for given segments of the route. He must demonstrate his ability to handle the aircraft in the NOE environment with ease and finesse. The aviator must be capable of making necessary radio transmissions and applying navigational data given him by the copilot/observer.

Requirement 2

NOE Navigation

Description. During a given segment of the course, the instructor pilot will take the controls and the aviator will navigate. When the aviator has proven that he can navigate accurately, the instructor pilot will create a situation (mission change) requiring a route deviation. The new route must allow the aircraft to remain masked.

Performance objectives. The aviator must navigate to an accuracy within 100 meters. He must demonstrate sound tactical judgment in planning the route deviation. The new route must offer suitable masking opportunity.

Requirement 3

Time-Distance Computation

Description. For a given segment of a route of flight, the aviator will be required to fly low level and to compute his estimated time of arrival at a series of successive checkpoints.

Performance objectives. The aviator must demonstrate his ability to calculate his estimated time of arrival at successive checkpoints. He will then be required to fly that segment of the course, arriving at the checkpoints within a 2-minute time frame (ETA plus or minus 1 minute). This procedure will continue until he has negotiated all checkpoints.

Requirement 4

Quick Stop

Description. At a time of his choosing, the instructor pilot will describe a situation which will require the aviator to execute an NOE "quick stop."

Performance objectives. The aviator must demonstrate decisiveness in executing the "quick stop." Through his actions he must indicate his knowledge of the correct technique to be employed, and his performance on the controls must be smooth and coordinated.

Requirement 5

Low Level Autorotation and Emergency Procedures.

Description. Low level autorotation will be practiced only in those areas that are designated by applicable regulations and have appropriate supervision. Emergency procedures critical during low level, contour, and NOE flight will be discussed.

Performance objectives. The aviator must perform the maneuver to the degree required for currency in his particular aircraft, recognizing that the quick stop technique and zero forward speed requirements of an actual failure at NOE cannot be practiced with power off. The aviator will accurately identify critical emergency situations and be able to state the correct emergency procedures.

Requirement 6

Hover Out-of-Ground-Effect

Description. The terrain/vegetation must be such that the aviator will be able to perform a high hover using a terrain feature for cover and concealment. The ideal terrain would be the sheer wall of a cliff with sufficient space for maneuver at the bottom. However, a tree line of sufficient height, a hill, or a ridgeline will also serve the purpose. The aviator will be required to land his aircraft and then raise it to a high-hover altitude, sufficient to permit observation/firing over the terrain feature being used.

Performance objectives. The aviator must demonstrate the requisite pilot techniques in bringing his aircraft to a high hover. (Density altitude and individual aircraft performance characteristics must be considered in selecting the hover height.) All control movements should be smooth and coordinated. The aviator must maintain his relative position over the ground at a specified height for a 3-minute period.

Requirement 7

Confined Area Approach

Description. The terrain selected for this requirement should approximate what is generally known to Army aviators as a "red-tire" confined area; one which is exceedingly restrictive as to maneuver space. Terrain should provide adequate flightpaths into and out of the area, but should not be so obvious as to dictate the approach path. On the ground, the confined area should tax the aviator's knowledge of aircraft dimensions. The flight evaluator will require an explanation of the planning considerations for confined area operations and then will have the aviator execute the approach and takeoff from the area.

Performance objectives. The aviator must demonstrate requisite knowledge of the planning considerations for confined area operations. He will demonstrate his knowledge of the aircraft's dimensions and his ability to hover his aircraft in the confined area precisely. He must execute the approach and takeoff using approved techniques as outlined in the appropriate aircraft operator's manual or standardization guide.

Requirement 8

Use of Protective Mask

Description. During an appropriate segment of the route of flight, the instructor pilot will require the aviator to don his protective mask (M-24 CBR). Wearing the mask, the aviator will be required to fly his designated course to the next requirement station, remaining nap-of-the-earth and performing all normal functions as pilot in command. The instructor pilot should be aware of possible incorrect perceptions of distance and height due to mask lens distortion.

Performance objectives. The aviator must demonstrate his ability to fly the aircraft while wearing the protective mask. Duration of the time element is optional, but should be of sufficient length to familiarize the aviator with the problems associated with flight while wearing the mask.

Requirement 9

Mission Planning

Description. The aviator will be given a mission to plan. The mission should be of sufficient complexity to tax the aviator's planning ability. The scope should be realistic, e.g., a captain should plan a platoon mission; a lieutenant a section mission. The mission should be planned for execution under conditions of radio silence. Planning should include at least route or routes selection, confirmation of map accuracy with aerial photos (if available), planning of suppressive fires, and coordination with friendly forces. When possible, the plan should be executed to test its validity.

Performance objectives. Mission planning will be thorough and complete. The plan will be feasible within the capabilities of the unit and tactically sound.

Requirement 10

Night Terrain Flight

Description. The aviator will demonstrate proficiency in night terrain flight and navigation. Contour and low level flight will be conducted without the aid of night vision devices. Because the altitude will be determined by the ambient light, the flight should be planned to take advantage of the highest light conditions. If night vision devices are available, the aviator will demonstrate proficiency in night NOE.

Note: The instructor pilot must evaluate the aviator's night proficiency prior to the flight. He should know the aviator's previous night NOE, contour, and low level training; total night experience; and recent night experience. This information will allow him to better judge the aviator's limits. This note also applies to requirement 11.

Performance objective. The aviator must demonstrate that he is capable of employing terrain flight during night operations.

Requirement 11

Blackout Insertion/or Comparable Unit Oriented Mission

Description. This requirement is envisioned as follows: The tactical situation will require the insertion of a single aerorifle squad. One LOH, one utility helicopter, and one attack helicopter will be assigned to the mission. Preceding the utility and attack aircraft, the LOH must locate and reconnoiter the designated LZ. The LZ should be "blacked-out" to increase difficulty. The attack and lift aircraft must navigate accurately. The LOH will provide pertinent data (landing heading, wind, and obstacles) to the lift aircraft. The attack helicopter will provide overwatch. Following the simulated insertion, all aircraft will return to the start point, using a designated route. Appropriate flight levels will be maintained throughout. If night vision devices are used, the flight should incorporate NOE. Communications must be maintained between aircraft. Position lights should be used as a safety warning when proximity warrants. The searchlight should be set on the UH-1 in the event safety demands its use during the touchdown.

Performance objective. Each aviator must demonstrate required proficiency in executing his particular function during the operation.

APPENDIX A

Key References

Army Regulations

95-1 Army Aviation - General Provisions and Flight Regulations.

Field Manuals

1-5 Instrument Flying and Navigation for Army Aviators (replacing TM 1-215 and TM 1-225). (Available Mid-1976).

1-40 Helicopter Gunnery.

1-80 Aerial Observer Techniques and Procedures.

1-100 Army Aviation Utilization.

6-20 Field Artillery Tactics and Operations.

6-40 Field Artillery Cannon Gunnery.

6-102 Field Artillery Battalion, Aerial Field Artillery.

17-1 Armored Operations.

17-30 The Armored Brigade.

17-37 Air Cavalry Squadron.

21-26 Map Reading.

30-5 Combat Intelligence.

30-10 Military Geographic Intelligence (Terrain).

57-35 Airmobile Operations.

61-100 The Division.

90-1 Employment of Army Aviation Units in a High Threat Environment. (Available Early 1976).

100-26 The Air-Ground Operations System.

Training Circulars

1-20 Aeromedical Training of Flight Personnel.

1-28 Rotary Wing Night Flight. (Available Mid-1976).

6-40-4 Fire for Effect. (Available early 1976).

17-17 Air Cavalry Attack Helicopter Crew Qualification Course.

APPENDIX B

Preliminary Training Course

Objectives.

This course (fig B-1) can be used as an element of initial qualification training to satisfy the NOE flight maneuvers training objective. The course is designed to develop and/or refresh the aviator's proficiency to perform NOE flight maneuvers and to develop lateral clearance judgment. It does not eliminate the need to conduct initial qualification training because it does not satisfy two major objectives (familiarization with the high threat environment and NOE navigation) of initial qualification training. Because most phases of the course can be set up on an airfield or small training area, it can be used by units such as some National Guard and Reserve units which may have limited access to NOE training areas. This frees the unit to concentrate on navigation and advanced training when NOE training areas are available.

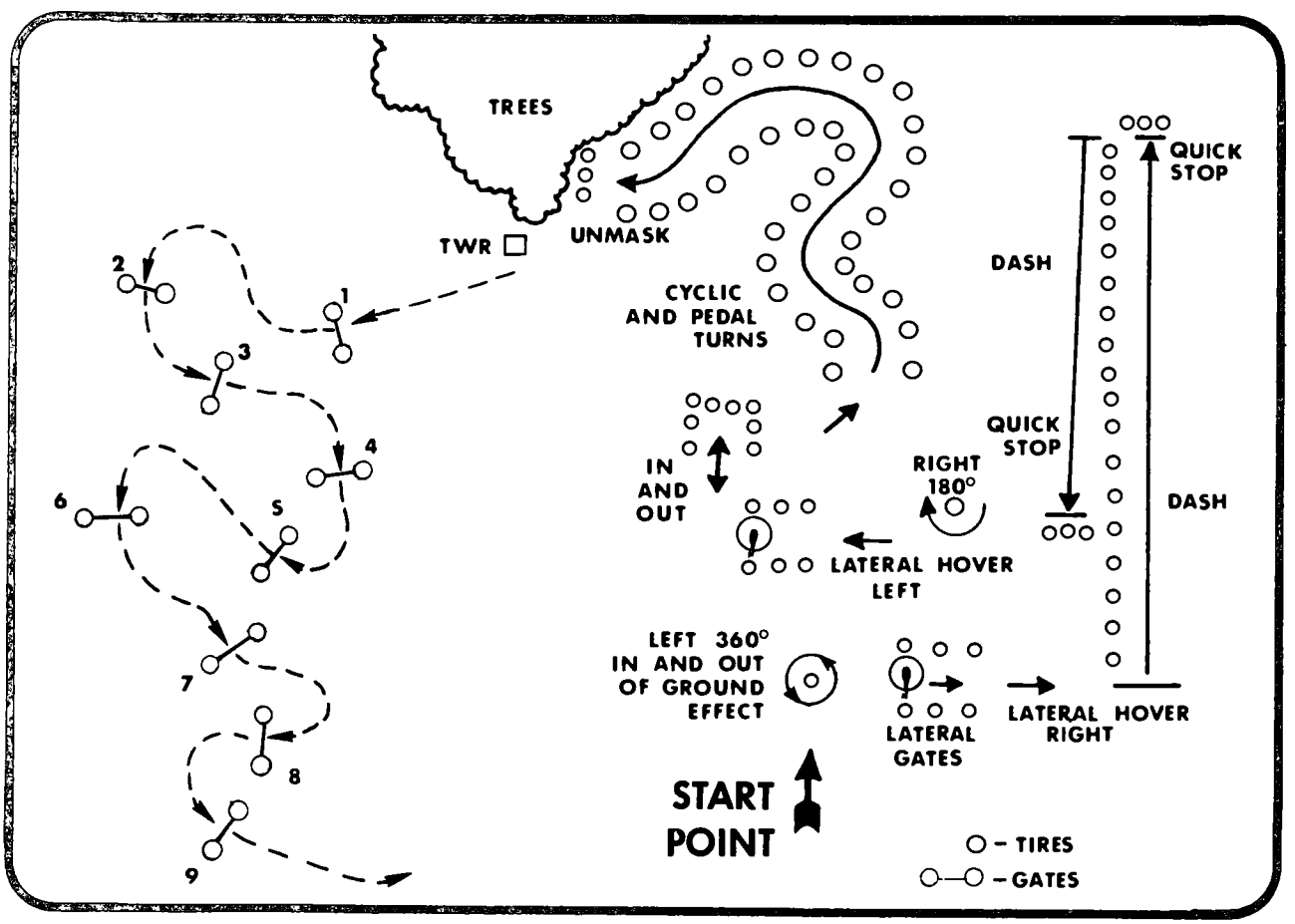


Figure B-1. Preliminary training course.

Course Description.

The course is divided into two phases - a maneuver phase and a lateral clearance judgment phase.

■ The maneuver phase consists of a series of basic maneuvers required for NOE flight. Tires are used to determine boundaries for each maneuver. Ground observers are used to visually determine that the pilot does not allow the main rotor or tail rotor to pass over the tires. Appropriate signals should be used to tell the pilot immediately if he fails to maintain clearance.

■ The lateral clearance judgment phase is designed to train the aviator to determine if he can go between obstacles or whether he must go over or around them. The aviator develops clearance judgment by negotiation of a series of nine adjustable gates (fig B-2). The gates should be adjustable for the type aircraft which will use the course and to various clearance limits. No two should be the same width. Some of the gates should not have sufficient clearance for the aircraft to pass through - a few should be easy. It will be up to the pilot to determine if sufficient clearance is available to maneuver through each gate. Any gate through which an aircraft will pass should be at least as wide as the main rotor diameter plus a 4-foot safety margin. The number of times the aviator runs through the gates will be based on individual performance. Before the pilot makes subsequent runs through the gates, the width of each gate should be altered.

When suitable terrain and/or vegetation exists, it is recommended that the gate training be followed by training on a course consisting of vegetation and/or terrain obstacles (fig B-3). Each course should consist of at least nine obstacles. Because the aviator will probably memorize the course after he has been through it once, at least three courses should be established. The distance between obstacles should be measured and the IP should know which obstacles can't be cleared.

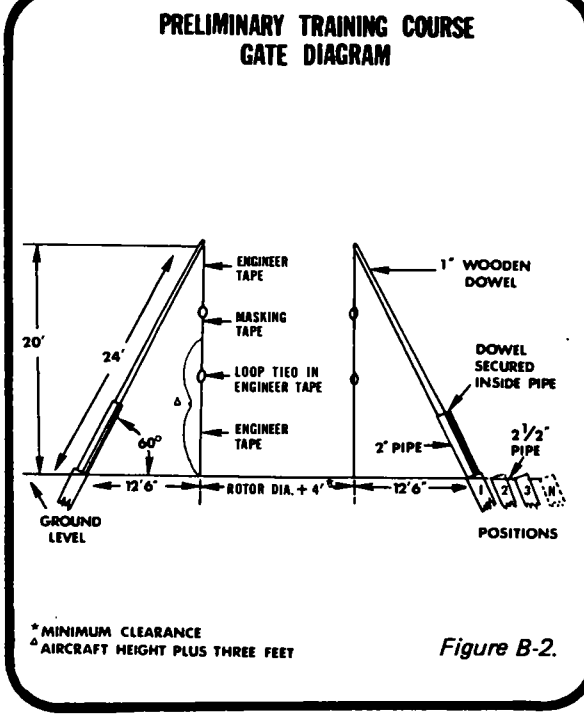


Figure B-2.

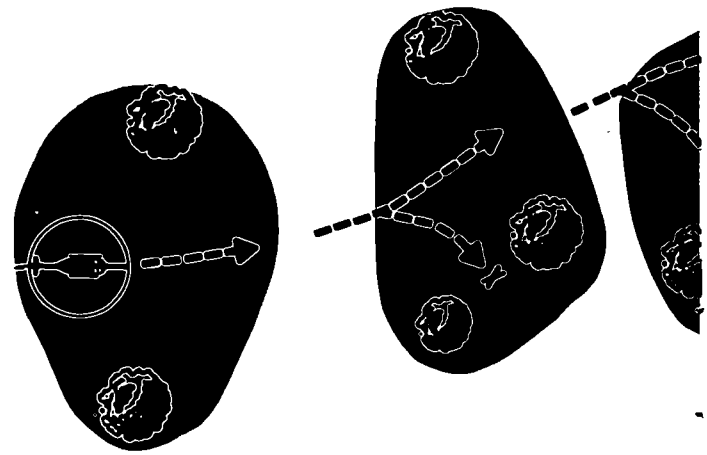


Figure B-3.

Method of Operation.

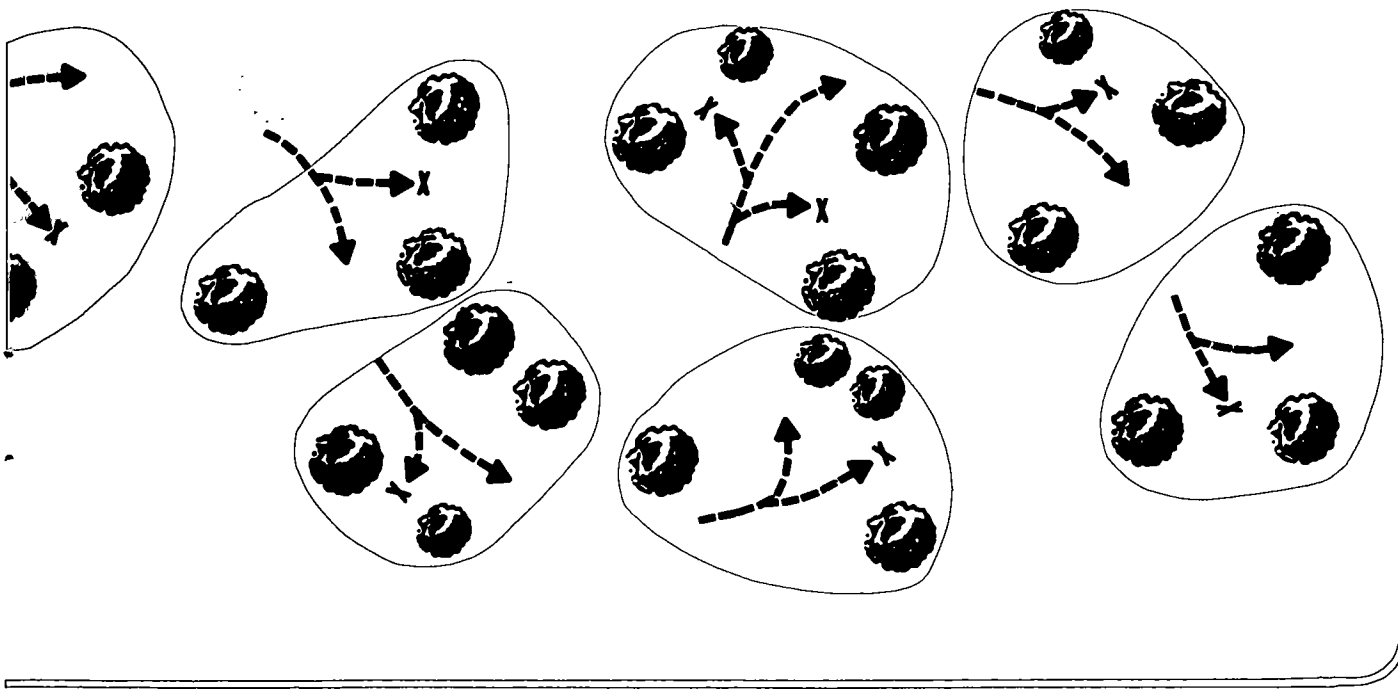
The commanding officer of the using unit (or his designated representative) will assume operational control and maintenance of the course. Radio communication will be maintained between each aircraft utilizing the course and the controlling agency. All aircraft utilizing the course during a specified time frame will be of the same type to avoid lengthy rearrangement of the gates. Also, there will be only two aircraft on the course at the same time - one in the maneuver phase and one in the lateral clearance judgment phase.

Aircraft crews will consist of an instructor pilot and a pilot. If appropriate, two pilots may be cleared for solo flight through the course by an instructor pilot.

Sequence of Maneuvers. (Figure B-1).

Reposition from parking space on taxiway to start point upon clearance from controlling agency.

- ☐ Hovering in and out of ground effect.
- ☐ 360° clearance turn - left.
- ☐ Lateral gates clearance.
- ☐ Lateral hover - right.
- ☐ Dash.
- ☐ Quick stop.
- ☐ Pedal turn.
- ☐ Dash.
- ☐ Quick stop.
- ☐ 180° clearance turn - right.
- ☐ Lateral hover - left.
- ☐ Lateral gates clearance.
- ☐ Rearward hover.
- ☐ Cyclic and pedal turns.
- ☐ Unmask.
- ☐ Gates 1 through 9.



APPENDIX C

NOE Flight Maneuvers

These flight maneuvers as discussed will be executed in a UH-1 helicopter. They can be applied to AH-1, OH-58, and OH-6 helicopters with minimum modification. In addition to this information, Standardization Guides for each aircraft detail additional flight maneuvers, procedures, and requirements. Also, the flight training guide for the UH-1 Contact Nap-of-the-Earth Instructor Pilot MOI Course will provide additional training information for flight maneuvers. These publications are available by writing Commander, U.S. Army Aviation Center, Army-wide Training Support, ATTN: ATZQ-T-AWTS, Fort Rucker, Alabama 36362.

Hovering out of ground effect.

Standard.

The aviator must perform hovering out of ground effect, within the following tolerances:

(1) Hover check at 5 feet ± 1 foot followed by a 360° left pedal turn.

(2) Hover check at 10 feet ± 2 feet followed by a 360° left pedal turn.

(3) Hover check at 25 feet ± 5 feet followed by a 360° left pedal turn.

(4) Rate of turns will not exceed 360° in 15 seconds.

(5) Power not to exceed go-no-go limitations.

(6) Remain over pivot point ± 5 feet.

Maneuver requirements.

(1) Before takeoff check.

(2) Clear left, right, and overhead.

(3) Hover checks at 5, 10, and 25 feet; power not to exceed go-no-go limitations.

(4) Left pedal turns at 5, 10, and 25 feet.

(5) Remain over the pivot point.

Analysis of maneuver.

(1) Perform a takeoff to a 5-foot hover.

(2) At a stabilized 5-foot hover into the wind, check hover power, initiate a 360° left pedal turn, and note maximum N_1 and torque.

(3) If power does not exceed go-no-go limitations, apply sufficient collective pitch to vertically ascend to a stabilized 10-foot hover while adjusting cyclic and pedals to remain over the pivot point and maintain heading. Check hover power and initiate a 360° left pedal turn and note maximum N_1 and torque.

(4) If power does not exceed go-no-go limitations, apply sufficient collective pitch to vertically ascend to a stabilized 25-foot hover while adjusting cyclic and pedals to remain over the pivot point and maintain heading. Check hover power and initiate a 360° left pedal turn and note maximum N_1 and torque.

(5) Lower sufficient collective to initiate a smooth, constant rate of descent and land from a hover.

(6) If at 25 feet maximum N_1 and torque did not exceed go-no-go limitations and no adverse control responses were noted, sufficient power is available to operate nap-of-the-earth.

Common errors.

(1) Failure to maintain heading control.

(2) Abrupt antitorque pedal movements causing erratic N_1 and torque readings.

(3) Failure to remain over pivot point.

Nap-of-the-earth takeoff.

Standard.

The aviator must perform a nap-of-the-earth takeoff within the following tolerances:

(1) Maintain heading ± 5°.

(2) Altitude - minimum obstacle clearance.

(3) Power not to exceed go-no-go limitations.

Maneuver requirements.

(1) Before takeoff check completed to include hover power and go-no-go chart.

(2) Clear left, right, and overhead.

(3) Maintain heading.

(4) Transition to nap-of-the-earth flight.

Analysis of maneuver.

(1) Perform before takeoff check (to include checking go-no-go placard) and if load is increased, density altitude increases, or the pilot has reason to believe the power requirements have changed, a hovering out-of-ground-effect check should be completed.

(2) Takeoff should be made over the lowest barriers to provide masking for the aircraft.

(3) Place the cyclic slightly forward of the neutral position. Simultaneously increase collective pitch to maintain a constant rate of climb until the barriers are cleared. Maintain directional control with antitorque pedals.

(4) As the barriers are cleared, lower collective pitch to smoothly transition to nap-of-the-earth flight.

Note. The direction of a nap-of-the-earth takeoff will be determined by the enemy situation. Regardless of wind, density altitude, and long axis of the area, if the threat of enemy observation is high, the takeoff will be made to take advantage of available terrain and vegetation masks. If the threat of enemy observation is low, conventional takeoff considerations can be used to determine takeoff direction.

Note: To take off downwind requires approximately 2 percent more N_1 than a takeoff into the wind.

Common errors.

(1) Failure to maintain heading.

(2) Accelerating too rapidly requiring excess power.

(3) Failure to maintain constant angle of climb.

(4) Failure to smoothly transition to nap-of-the-earth flight.

Nap-of-the-earth approach.

Standard. The aviator must perform a nap-of-the-earth approach, within the following tolerances:

(1) Entry altitude as dictated by tactical situation.

(2) Entry airspeed as dictated by tactical situation.

(3) Approach angle of 0° to 90°.

(4) Heading ± 5°.

Maneuver requirements.

(1) Before landing check completed.

(2) Entry altitude as required.

(3) Entry airspeed as required.

(4) Approach angle 0° to 90°.

Analysis of maneuver.

(1) The copilot/observer must navigate the pilot to the LZ and inform the pilot when he is 1/2 to 1/4 mile from the LZ to allow the pilot to adjust the airspeed.

(2) After intercepting the approach angle, reduce the collective to maintain minimum approach angle. Complete the approach.

Common errors.

(1) Failure to maintain proper rate of closure.

(2) Excessive airspeed on final.

(3) Failure to terminate approach to the ground.

Nap-of-the-earth downwind approach.

Standard. The aviator must perform a nap-of-the-earth downwind approach within the following tolerances:

(1) Entry altitude as directed by the tactical situation.

(2) Entry airspeed as directed by the tactical situation.

(3) Approach angle of 0° to 90°.

(4) Heading ± 5°.

(5) Downwind condition not to exceed 10 knots.

Maneuver requirements.

(1) Before landing check completed.

(2) Entry altitude as required.

(3) Entry airspeed as required.

(4) Approach angle of 0° to 90°.

Analysis of maneuver.

(1) Accomplish approach.

(2) During the nap-of-the-earth downwind approach, the rate of closure must be slower to avoid extremely tail-low altitudes during touchdown.

Common errors.

(1) Failure to maintain heading.

(2) Failure to maintain rate of closure.

(3) Failure to maintain constant approach angle.

(4) Excessive tail-low altitude during touchdown.

Nap-of-the-earth quick stop.

Standard.

The aviator must perform a nap-of-the-earth quick stop within the following tolerances:

(1) Maintain heading ± 5°.

(2) Maintain altitude of the tail rotor.

Maneuver requirements.

(1) Maintain altitude of the tail rotor.

(2) Maintain heading.

(3) Decelerate to a full stop.

Analysis of maneuver.

(1) Increase collective pitch while simultaneously apply aft cyclic control to maintain the altitude of the tail rotor for obstacle clearance. Adjust antitorque pedals as necessary to maintain desired heading.

(2) After decelerating to a full stop, allow the fuselage of the aircraft to descend while continuing to maintain the altitude of the tail rotor.

Common errors.

(1) Failure to maintain altitude of tail rotor.

(2) Failure to maintain heading.

(3) Failure to descend to original altitude.

Masking and unmasking.

Standard.

The aviator must perform masking and unmasking within the following tolerances:

(1) Masked - maintain aircraft masked from enemy observation.

(2) Unmasked - exposure of aircraft will not exceed 10 seconds.

Maneuver requirements.

(1) Before landing check completed.

(2) Altitude as required.

(3) Thorough map reconnaissance.

Analysis of maneuver.

(1) In flight, perform a thorough map reconnaissance to minimize exposure of the aircraft to either enemy visual or electronic observation.

(2) Perform a hovering out of ground effect check to insure sufficient power is available to perform unmasking.

(3) Takeoff to a hover and continue to apply collective pitch until sufficient altitude is gained to see over or through the mask.

(4) Whenever possible, perform masking and unmasking at a safe distance from the mask to allow the aircraft to rapidly descend from unmasked to masked in case it is detected and fired on.

(5) Descend vertically to a masked condition.

Common errors.

(1) Remaining unmasked over 10 seconds.

(2) Overexposure due to incorrect terrain interpretation.

(3) Failure to maintain obstacle clearance.

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
Chief of Staff

Official:
PAUL T. SMITH
Major General, United States Army
The Adjutant General

Distribution:
Active Army, ARNG, USAR: To be distributed in accordance with DA Form 12-llA requirements for Aviation Company; Aviation Company, Battalion, Group and Brigade; Attack Helicopter Gunnery; Army Aviation Techniques and Procedures; Field Artillery Battalion, Aerial Field Artillery; Infantry Battalions; Divisonal Armored and Air Cavalry Units; Air Cavalry Squadron. (Qty rqr block numbers 1, 3, 4, 8, 65, 79, 131, and 132).

FM 1-1
TERRAIN FLYING
PENTAGON LIBRARY
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SEABOARD
COAST LINE
Dillard
Pleasant Grove
Ch
Cem
Creek
BM
450
400
350
300
356
328
363
314
231
52

ALABAMA 1:50,000

BRUNDIDGE

EDITION 2-AMS

SHEET 3847 III
SERIES V744

A. The aviator planned his route to cross all ridge lines at a low point.

B. As the aircraft crosses this ridge, it may be exposed to enemy radar located at Tarentum; therefore, the pilot plans to cross as low and quickly as possible.

C. He planned his route to follow streambeds because the low terrain provides masking. Also, by following streams, navigation is made easier. However, he knows that when he is within effective range of enemy AD weapons, that a stream is an avenue of approach and therefore, under visual or radar surveillance.

D. The pilot expects unplotted wire hazards along this and all other roads he crosses.

E. During the map study, the pilot and crewmember navigating identify specific multiple terrain features which will aid in recognizing each turning point.

F. Special notations of wire hazards along the route are marked on the map.

G. The risk of exposure when crossing this open field is reduced because the trees on the north and west sides of the field provide some masking so long as the aircraft is below the treeline.

H. During planning, the crew identifies this as a potentially dangerous area because it is high open ground probably exposed to enemy radar. Also, there are probably numerous hazards in the area. Therefore, prior to crossing the area where they may be exposed, the crew will conduct a reconnaissance to identify the point where they will enter the draw on the forward slope of the hill and all hazards.

I. Due to the proximity of enemy weapons, the landing zone will be entered and departed over the lowest barriers regardless of winds.

J. During planning, the crew identified these as areas where exposure was likely and therefore, requested artillery suppression of enemy air defense weapons at Tarentum when in the area.

K. Boundaries, such as this road, were identified for most turning points in case the turning point was missed.

V744, EDITION 2-AMS

Prepared by the Army Map Service (LU), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1966 from Alabama, 1:25,000, AMS, Sheets 3847 III NE, NW, SE, SW, field checked 1965. Horizontal and vertical control by USC&GS, AMS and CE. This map complies with the national standard map accuracy requirements. Map not field checked.

Scale 1:50,000

1 ½ 0 1 2 3 Statute Miles
1000 500 0 1000 2000 3000 4000 Meters
1000 500 0 1000 2000 3000 4000 Yards
1 ½ 0 1 2 3 Nautical Miles

CONTOUR INTERVAL 20 FEET
VERTICAL DATUM: SEA LEVEL DATUM 1929

TRANSVERSE MERCATOR PROJECTION
HORIZONTAL DATUM: 1927 NORTH AMERICAN DATUM

BLACK NUMBERED LINES INDICATE THE 1000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 16

REFER CORRECTIONS TO THIS MAP TO COMMANDING OFFICER, ARMY MAP SERVICE, WASHINGTON, D.C.

GRID ZONE DESIGNATION: 16R	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METERS
100,000 M. SQUARE IDENTIFICATION	SAMPLE POINT: MT OLIVE CHURCH
EL FL / EK FK (3500 / 600)	1. Read letters identifying 100,000 meter square in which the point lies: FL 2. Locate first VERTICAL grid line to LEFT of point and read LARGE figures labeling the line either in the top or bottom margin, or on the line itself; Estimate tenths from grid line to point: 09 5 3. Locate first HORIZONTAL grid line BELOW point and read LARGE figures labeling the line either in the left or right margin, or on the line itself; Estimate tenths from grid line to point: 02 3
IGNORE the SMALLER figures of any grid number; these are for finding the full coordinates. Use ONLY the LARGER figures of the grid number; example: 3486000	SAMPLE REFERENCE: FL095023 If reporting beyond 18° in any direction, prefix Grid Zone Designation, as: 16RFL095023

GRID CONVERGENCE 0°35′ (10 MILS) FOR CENTER OF SHEET

GN — GRID NORTH — MAGNETIC NORTH — TRUE NORTH

1965 G-M ANGLE 2° (40 MILS)

TO CONVERT A MAGNETIC AZIMUTH TO A GRID AZIMUTH ADD G-M ANGLE

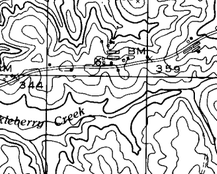
TO CONVERT A GRID AZIMUTH TO A MAGNETIC AZIMUTH SUBTRACT G-M ANGLE

LEGEND

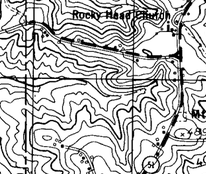
Tint indicates areas in which only landmark buildings are shown
ROAD DATA 1965
In developed areas, only through roads are classified

- Hard surface, heavy duty road, four or more lanes wide
- Hard surface, heavy duty road: Two lanes wide; Three lanes wide
- Hard surface, medium duty road, four or more lanes wide
- Hard surface, medium duty road: Two lanes wide; Three lanes wide
- Improved light duty road, street
- Unimproved dirt road
- Trail
- Route markers: Interstate; Federal; State
- Buildings
- Barns, sheds, greenhouses, stadiums, etc.
- RAILROADS: Standard gauge (Single track, Multiple track); Narrow gauge; In street; Carline
- Bench mark, monumental
- Bench mark, non-monumented
- Spot elevations in feet: Checked; Unchecked
- Light, lighthouse; Windmill, wind pump; Water mill
- BOUNDARIES: National; State (with monument); County; County subdivision; Corporate limits; Military reservation; Other reservation
- Woods or brushwood
- Vineyard; Orchard
- Intermittent lake
- Intermittent stream; Dam
- Marsh or swamp
- Rapids; Falls
- Large rapids; Large falls

ELEVATION GUIDE

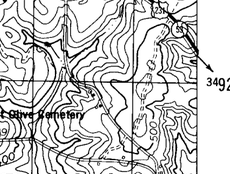


ADJOINING SHEETS



Sheet 3847 III falls within NH 16-3, V501, 1:250,000

BOUNDARIES



A. Pike County
B. Coffee County
C. Dale County

High
Medium
Low

8-73 PRINTED BY ARMY MAP SERVICE, CORPS OF ENGINEERS

OVERPRINT PREPARED BY 1203D ENGR BN T. A.
ALABAMA ARMY NATIONAL GUARD

Map A

BRUNDIDGE, ALABAMA
STOCK NO. V744X38473***02

ALABAMA 1:50,000

BRUNDIDGE

EDITION 2-AMS

SHEET 3847 III
SERIES V744

V744, EDITION 2-AMS

Prepared by the Army Map Service (LU), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1966 from Alabama, 1:25,000, AMS, Sheets 3847 III NE, NW, SE, SW, field checked 1965. Horizontal and vertical control by USC&GS, AMS and CE. This map complies with the national standard map accuracy requirements. Map not field checked.

Scale 1:50,000

1 ½ 0 1 2 3 Statute Miles

1000 500 0 1000 2000 3000 4000 Meters

1000 500 0 1000 2000 3000 4000 Yards

1 ½ 0 1 2 3 Nautical Miles

CONTOUR INTERVAL 20 FEET
VERTICAL DATUM: SEA LEVEL DATUM 1929

TRANSVERSE MERCATOR PROJECTION
HORIZONTAL DATUM: 1927 NORTH AMERICAN DATUM

BLACK NUMBERED LINES INDICATE THE 1000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 16

REFER CORRECTIONS TO THIS MAP TO COMMANDING OFFICER, ARMY MAP SERVICE, WASHINGTON, D.C.

GRID ZONE DESIGNATION: 16R	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METERS
100,000 M. SQUARE IDENTIFICATION: EL FL / EK FK	SAMPLE POINT: MT OLIVE CHURCH
IGNORE the SMALLER figures of any grid number; these are for finding the full coordinates. Use ONLY the LARGER figures of the grid number; exemple: 3486000	1. Read letters identifying 100,000 meter square in which the point lies: FL 2. Locate first VERTICAL grid line to LEFT of point and read LARGE figures labeling the line either in the top or bottom margin, or on the line itself: Estimate tenths from grid line to point: 09 5 3. Locate first HORIZONTAL grid line BELOW point and read LARGE figures labeling the line either in the left or right margin, or on the line itself: Estimate tenths from grid line to point: 02 3
	SAMPLE REFERENCE: FL095023
	If reporting beyond 18° in any direction, prefix Grid Zone Designation, ex: 16RFL095D23

LEGEND

Tint indicates areas in which only landmark buildings are shown
ROAD DATA 1965
In developed areas, only through roads are classified

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- Rapids; Falls
- Large rapids; Large falls

GN — HURON GRID — MAGNETIC NORTH — TRUE NORTH

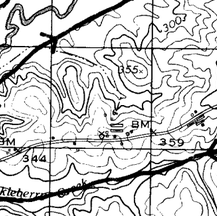
1965 G-M ANGLE 2° (40 MILS)

GRID CONVERGENCE 0°35′ (10 MILS) FOR CENTER OF SHEET

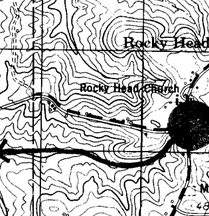
TO CONVERT A MAGNETIC AZIMUTH TO A GRID AZIMUTH ADD G-M ANGLE

TO CONVERT A GRID AZIMUTH TO A MAGNETIC AZIMUTH SUBTRACT G-M ANGLE

ELEVATION GUIDE

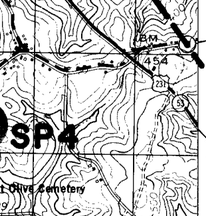


ADJOINING SHEETS



Sheet 3847 III falls within NH 16-3, V501, 1:250,000

BOUNDARIES



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Map B

BRUNDIDGE, ALABAMA
STOCK NO. V744X38473***02